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SPORT FISHERY ABSTRACTS

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SPORT FISHERY ABSTRACTS

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Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

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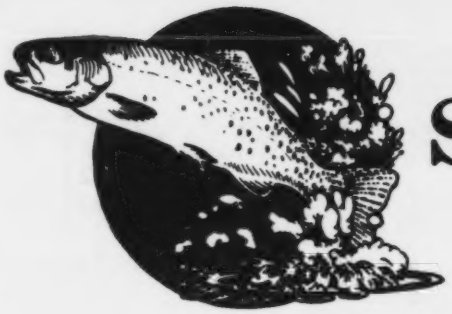

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Alabama: Claude Peteet Maricult. Cent.
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Alabama: Dauphin Island
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Alabama: Halawakee Creek
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Alabama: Lee County Lake
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Alabama: Lewis Smith Reservoir
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Alabama: Luxapalila River
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Alabama: Mississippi Sound
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Alabama: Mobile Bay
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Alabama: North River
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Alabama: Pickwick Reservoir
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Alabama: Tallapoosa River
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Arizona: Cholla Lake
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Atlantic Ocean, North: Bay of Biscay
71-005050

Atlantic Ocean, North: Canada: Newfoundland
71-006743

Atlantic Ocean, North: Canary Current
71-007966

Atlantic Ocean, North: Celtic Sea
71-001825

Atlantic Ocean, North: Cumberland Sound
71-006421

Atlantic Ocean, North: Faeroe Islands
71-009549

Atlantic Ocean, North: Gulf of St. Lawrence
71-007990
71-008682

Atlantic Ocean, North: Norfolk Canyon
71-008264

Atlantic Ocean, North: Norway
71-008971

Atlantic Ocean, North: Norwegian Sea
71-008093

Atlantic Ocean, North: Scotian Shelf
71-008029

Atlantic Ocean, North: South Atlantic Bight
71-006688
71-008265

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Atlantic Ocean, North: South Atlantic Bight
71-008266
71-008267
71-013174

Atlantic Ocean, Northeastern
71-006718
71-007905
71-007970
71-008811

Atlantic Ocean, Northwestern
71-001732
71-005585
71-008448
71-008883

Atlantic Ocean, South
71-001515
71-005481
71-005642
71-005643
71-006387
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71-013180

Atlantic Ocean, South: Scotia Sea
71-008117

Atlantic Ocean, South: South Georgia
71-007424

Atlantic Ocean, Southeastern
71-002008
71-005972
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71-013268

Atlantic Ocean, Southwestern
71-001651
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71-008132
71-008649
71-008651
71-011833

Atlantic Ocean, Tropical
71-008175
71-008832

Atlantic Ocean, Tropical Western
71-004873
71-008808

Atlantic Ocean, West Central
71-013183
71-013187
71-013189

Atlantic Ocean, Western
71-008510
71-008522
71-008549

Atlantic Ocean: Africa
71-007684
71-008062
71-008190

Atlantic Ocean: Antilles Current
71-007897

Atlantic Ocean: Baffin Island
71-010040

Atlantic Ocean: Bahama Islands
71-006696

Atlantic Ocean: Canada
71-008559
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71-013254

Atlantic Ocean: Canada: Newfoundland
71-005505

Atlantic Ocean: Chincoteague Bay
71-009836

Atlantic Ocean: Delaware: Delaware Bay
71-005835

Atlantic Ocean: English Channel
71-010127

Atlantic Ocean: Finland
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71-006120
71-006726

Atlantic Ocean: Florida
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71-009375
71-013228

Atlantic Ocean: Georges Bank
71-006574
71-007793

Atlantic Ocean: Georgia
71-001490
71-005722
71-009886
71-009887

Atlantic Ocean: Gulf of Finland
71-006139
71-006709

Atlantic Ocean: Gulf of Guinea
71-006796

Atlantic Ocean: Gulf of Maine
71-007793
71-008428

Atlantic Ocean: Gulf of St. Lawrence
71-005336

Atlantic Ocean: Gulf of Maine
71-008428

Atlantic Ocean: Gulf of St. Lawrence
71-005336
71-006159
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71-007983

Atlantic Ocean: Long Island Sound
71-001610
71-006579
71-007398
71-007598

Atlantic Ocean: Massachusetts: Cape Cod
71-004751

Atlantic Ocean: Mid-Atlantic Bight
71-005466
71-005764

Atlantic Ocean: Narragansett Bay
71-007163

Atlantic Ocean: New England
71-007903
71-009250

Atlantic Ocean: New Jersey
71-003530
71-006262
71-008069

Atlantic Ocean: New York
71-006711
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71-008290
71-010163
71-013163
71-013226

Atlantic Ocean: New York Bight
71-008277
71-009161
71-010524
71-013256

Atlantic Ocean: North Carolina
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71-008186
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71-011514

Atlantic Ocean: North Sea
71-007592
71-009773

Atlantic Ocean: Norwegian Sea
71-007286

Atlantic Ocean: Scagerac Sea
71-002666

Atlantic Ocean: Scotland
71-005614

Atlantic Ocean: South Carolina
71-005732
71-007695
71-011951

Atlantic Ocean: United States
71-013469

Atlantic Ocean: Venezuela
71-009099
71-009499

Atlantic Ocean: Virginia
71-008183

Atlantic Ocean: White Sea
71-002034

Australia
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Australia
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Australia, Southern
71-008634
Australia: Blackwood River Estuary
71-008009
Australia: Geographe Bay/Bunbury
71-008256
Australia: Great Barrier Reef
71-005355
71-005609
71-006095
71-006096
71-008235
71-008411
71-009695
Australia: Gwydir River
71-002527
71-006246
71-006849
71-007428
Australia: Heron Reef
71-005354
Australia: McKenzie River
71-006333
Australia: New South Wales
71-008273
71-011850
Australia: New South Wales: Lake Eucumbene
71-006548
Australia: New South Wales: Shoalhaven River
71-005501
Australia: New South Wales: Tallowa Dam
71-011882
Australia: Pacific Ocean
71-007992
Australia: Port Phillip Bay
71-009670
71-009671
Australia: Queensland
71-006785
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Australia: Queensland: Serpentina Creek
71-006690
Australia: Queensland: Trinity Bay
71-007742
Australia: Shark Bay
71-008010
Australia: Tasmania
71-005883
71-008456
71-008578
71-008681
71-010382
Australia: Victoria
71-008358
71-012126
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Australia: Victoria: Aberfeldy River
71-006998
Australia: Victoria: Acheron River
71-001277
Australia: Victoria: Murray River
71-007774
Australia: Victoria: Snobs Creek
71-001194
Australia: Victoria: Tullaroop Creek
71-012956
Australia: Victoria: Western Port
71-005806
Australia: Western Australia
71-012182
Australia: Western Australia: Swan-Canning Estuary
71-013133
Austria
71-007151
71-007888
Azores Islands
71-005183
Bahama Islands
71-004941
71-005019
71-006696
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Baltic Sea
71-000607
71-003512
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Baltic Sea
71-013318
Baltic Sea: Vistula Bay
71-008303
Baltic Sea: Vistula Lagoon
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Bangladesh
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71-008746
Barbados
71-001892
71-008137
Barents Sea
71-005631
71-005948
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71-005950
71-005951
71-007813
71-009733
71-009996
Belgium: Semois River
71-010359
Belize
71-008604
71-008605
71-009634
71-009635
Benin
71-009622
Bering Sea
71-001806
71-004071
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Bering Sea, Eastern
71-005913
Bering Sea: Commander Islands
71-004712
Bermuda
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Black Sea
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71-003270
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Black Sea: Kerch Strait
71-006550
Black Sea: Sea of Azov
71-008299
Bolivia
71-008842
Bolivia: Amazon River
71-008464
Bonneville Basin
71-005738
Brazil
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71-000545
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71-008022
71-008860
Brazil: Ceara
71-007433
Brazil: Patos Lagoon
71-005524
Brazil: Rio Grande do Sul State
71-008008
Brazil: Rio Madeira
71-012952
Brazil: Rio Negro
71-008856
71-008859
British Isles
71-004573
71-008271
Burundi: Lake Tanganyika
71-005579
California
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California
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California, Pacific Ocean
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California, Southern
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California, Southern: Pacific Ocean
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California: Alameda Creek
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California: Alamitos Bay
71-007687
California: Anaheim Bay
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California: Ash Creek
71-007064
California: Bruels Point
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California: Carmel Bay
71-006988
California: Castle Lake
71-003749
California: Clear Lake
71-006031
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California: Colusa Cty.
71-013347
California: Cottonwood Creek
71-006605
California: Coyote Creek
71-007680

California: Death Valley
71-003617
71-008066
California: Death Valley Natl. Monument
71-002010
California: Death Valley Natl. Monument: Saratoga Springs
71-004021
California: Deer Creek
71-004878
California: Desolation Wilderness
71-012132
California: Eagle Lake
71-001066
71-001352
California: Evewetak Lagoon
71-006680
California: Farallon Islands
71-008335
California: Friant-Kern Canal
71-008848
California: Half Moon Bay
71-006192
California: Hat Creek
71-012950
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California: Humboldt Bay
71-003559
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California: Humboldt Cty.: Freshwater Lagoon
71-012427
California: Humboldt Cty.: Redwood Creek
71-012113
California: Humboldt Cty.: Trinidad Bay
71-006050
California: Inyo City: Tecopa Bore
71-001358
California: Jackson Meadows Reservoir
71-012454
California: King Street Canal
71-005367
California: Klamath River
71-006846
71-008847
California: La Jolla
71-009533
California: Lake Almanor
71-005467
California: Lake Berryessa
71-012449
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California: Lake Casitas
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California: Lake Cty.: Clear Lake
71-007139
California: Lake Cty.: Clear Lake Basin
71-008238
California: Lake Greenhaven
71-005467
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California: Lake Havasu
71-007315
California: Lake Nacimiento
71-007404
California: Lake Perris
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California: Lake Tahoe
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California: Lassen Cty.
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California: Lassen Cty.: Eagle Lake
71-004556
California: Los Angeles
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California: Los Angeles Cty.
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California: Los Angeles Harbor
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California: Los Angeles: Pacific Ocean
71-008389
California: McCloud River
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California: Merle Collins Reservoir
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California: Modoc Cty.
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California: Modoc Cty.: Cowhead Lake
71-008481
California: Modoc Cty.: Rush Creek
71-012016
California: Mono Cty.: Bunny Lake
71-005799
California: Mono Cty.: Little Walker River
71-006891
California: Monterey Bay
71-001313
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California: Monterey Bay
71-007999
California: Morro Bay
71-003973
California: Napa Cty.: Lake Berryessa
71-001318
California: Newport Bay
71-005897
California: North Fork Feather River
71-012292
California: Orange Cty.
71-009609
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California: Pacific Current
71-007916
California: Pacific Ocean
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California: Pajaro River
71-008206
California: Pit River
71-001199
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California: Plumas Cty.: Frenchman Reservoir
71-012301
California: Point Conception
71-007822
California: Richardson Bay
71-007836
California: Rincon Point
71-013337
California: Riverside Cty.: Lake Perris
71-012858
California: Sacramento River
71-006358
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71-012463
California: Sacramento-San Joaquin Estuary
71-006130
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71-007525
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California: Sagehen Creek
71-006258
California: Salton Sea
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California: San Diego
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California: San Diego Cty.
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California: San Diego Cty.: Rancho Carrillo
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California: San Francisco Bay
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California: San Joaquin River
71-006555
California: San Pedro Bay
71-006208
California: Santa Barbara
71-004872
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71-007865
California: Santa Barbara Channel
71-006755
California: Santa Barbara Cty.
71-007721
California: Santa Catalina Basin
71-006692
California: Santa Clara River
71-007722
71-008057
California: Santa Cruz Cty.: Corcoran Lagoon
71-006193
California: Santa Cruz Island
71-006755
California: Santa Monica Bay
71-007845
71-009790
California: Shasta Lake
71-006143
California: Sheepheaven Creek
71-008591
California: Squirrel Creek
71-001274

California: Tecopa Bore
71-006056
California: Truckee River
71-006582
California: Ventura River
71-006551
California: Williamson Lakes
71-008592
California: Zzyzx Spring
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Cameroon: River Mungo
71-008806
Canada
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Canada, Western
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Canada: Alberta: Athabasca River
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Canada: Alberta: Lac Ste. Anne
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Canada: Alberta: Lake Wabamun
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Canada: Alberta: Lesser Slave Lake
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Canada: Alberta: North Raven River
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Canada: Alberta: Nose River
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Canada: Alberta: Paine Lake
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Canada: Alberta: Peace River
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Canada: Alberta: Peace-Athabasca Delta
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Canada: Alberta: Prince Albert Natl. Park
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Canada: Alberta: Sheep River
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Canada: Alberta: Steepbank River
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Canada: Alberta: Waterton Lakes
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Canada: Atlantic Ocean
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Canada: British Columbia
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Canada: British Columbia, Coastal
71-006716
Canada: British Columbia: Atnarko River
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Canada: British Columbia: Babine Lake
71-006706
Canada: British Columbia: Carnation Creek
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Canada: British Columbia: Centennial Creek
71-012074
Canada: British Columbia: Chilko Lake
71-009468
Canada: British Columbia: Chilko River
71-004405
Canada: British Columbia: Cowichan-Koksilah Rivers
71-005900
Canada: British Columbia: Duncan-Lardeau Rivers
71-012912
Canada: British Columbia: Fraser River
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Canada: British Columbia: Georgia Strait
71-005640
Canada: British Columbia: Glendale River
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Canada: British Columbia: Great Central Lake
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Canada: British Columbia: Heisholt Lake
71-004702
Canada: British Columbia: Horsefly River
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Canada: British Columbia: Howe Sound
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Canada: British Columbia: Juan De Fuca Strait
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Canada: British Columbia: Kootenay Lake
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Canada: British Columbia: Kootenay Trout Hatchery
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Canada: British Columbia: Nanaimo Estuary
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Canada: British Columbia: Nitinat Lake
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Canada: British Columbia: Pacific Ocean
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Canada: British Columbia: Port Renfrew
71-007419
Canada: British Columbia: Puntledge River
71-012429
Canada: British Columbia: Queen Charlotte Sound
71-012555
Canada: British Columbia: Quinsam River
71-006088
Canada: British Columbia: Rosewall Creek Hatchery
71-009123
Canada: British Columbia: Skeena River
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71-012767
Canada: British Columbia: Strait of Georgia
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Canada: British Columbia: Tsolum River
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Canada: British Columbia: Vancouver
71-001107
Canada: British Columbia: Vancouver Island
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Canada: British Columbia: Wapiti Lake Area
71-008182
Canada: British Columbia: Williston Reservoir
71-004734
Canada: Canso Strait
71-012004
Canada: Experimental Lakes Area
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Canada: Georges Bank
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Canada: Great Lakes
71-006000
Canada: Gulf of St. Lawrence
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Canada: James Bay
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Canada: Labrador
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Canada: Labrador: Churchill Falls
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Canada: Labrador: Ossokmanuan Reservoir
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Canada: Labrador: Smallwood Reservoir
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Canada: Lake Erie
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Canada: Lake Ontario
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Canada: Manitoba
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Canada: Manitoba: Assiniboine River
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Canada: Maritime Provinces
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Canada: New Brunswick: Gaspe
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Canada: New Brunswick: Miramichi Estuary
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Canada: New Brunswick: Miramichi River
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Canada: New Brunswick: St. John River
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Canada: Newfoundland: Atlantic Ocean
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71-006624
Canada: Newfoundland: Continental Shelf
71-006379
Canada: Newfoundland: Grand Bank
71-006206
Canada: Newfoundland: Gros Morne Natl. Park
71-005485
71-005811
Canada: Newfoundland: North Harbour River
71-006026
Canada: Newfoundland: Red Indian Lake
71-012884
Canada: Northumberland Strait
71-007841
Canada: Northwest Territories
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Canada: Northwest Territories: Baffin Island
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Canada: Northwest Territories: Char Lake
71-001291
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Canada: Northwest Territories: Saqvaqjuac River
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Canada: Northwest Territories: Strathcona Sound
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Canada: Northwest Territories: Trail River
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Canada: Nova Scotia
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Canada: Nova Scotia: Chedabucto Bay
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Canada: Nova Scotia: Gulf of Maine
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Canada: Nova Scotia: Jeddore Harbour
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Canada: Nova Scotia: Margaree River
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Canada: Nova Scotia: Miramichi River
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Canada: Nova Scotia: Scotian Shelf
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Canada: Ontario: Algonquin Park: Ryan Lake
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Canada: Ontario: Ball Lake
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Canada: Ontario: Experimental Lakes Area
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Canada: Ontario: Flack Lake
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Canada: Ontario: Gamitagama
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Canada: Ontario: George Lake
71-011054
Canada: Ontario: Hanlon Creek
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Canada: Ontario: Horner Lake
71-006469
Canada: Ontario: Jones Creek
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Canada: Ontario: Kawartha Lakes
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Canada: Ontario: Lac des Mille Lacs
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Canada: Ontario: Lake Lavieille
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Canada: Ontario: Lake Nipissing
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Canada: Ontario: Lake of the Woods
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Canada: Ontario: Little Minnow Lake
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Canada: Ontario: Nogies Creek
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Canada: Ontario: Ottawa River
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Canada: Ontario: Powell's Lakes
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Canada: Ontario: Rawson Lake
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Canada: Ontario: St. Clair River
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Canada: Ontario: St. Lawrence River
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Canada: Ontario: Sudbury Region
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Canada: Ontario: Thames River
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Canada: Ontario: Thames River, Middle Branch
71-005394
Canada: Ontario: West Blue Lake
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Canada: Pacific Ocean
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Canada: Prince Edward Island: North Brook
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Canada: Quebec
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Canada: Quebec: Becs-Scie River
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Canada: Quebec: Caniapiscau River
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Canada: Quebec: Gamelin Lake
71-005704
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Canada: Quebec: Gatineau Park
71-008174
Canada: Quebec: Gulf of St. Lawrence
71-001129
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Canada: Quebec: La Grande River
71-006948
Canada: Quebec: Lac Vert
71-007381
Canada: Quebec: Lake Beauchamp
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Canada: Quebec: Lake Croche
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Canada: Quebec: Lake Gamelin
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Canada: Quebec: Lake Memphremagog
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Canada: Quebec: Le Grande River
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Canada: Quebec: Lower Seal Lake
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Canada: Quebec: Schefferville
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Canada: Quebec: St. Lawrence River
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Canada: Saskatchewan
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Canada: Saskatchewan: Fond du Lac River
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Canada: Saskatchewan: Frenchman River
71-008173
Canada: Saskatchewan: Hasell Lake
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Canada: St. Lawrence River Estuary
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Canada: Yukon
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Canada: Yukon Territory
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Canada: Yukon Territory: Peel River Basin
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Canary Islands
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Caribbean Area
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Caribbean Area: Cuba
71-005230
Caribbean Area: Cuban Shelf
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Caribbean Sea
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Caspian Sea
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71-007971
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71-008402
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Celtic Sea
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Central America
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Ceylon
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Chesapeake Bay
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Chile: Pacific Ocean
71-006502
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Chile: Straits of Magellan
71-010091
Chile: Tejas Verdes: Maipo River
71-007299
China
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Colombia
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Colombia: Magdalena River
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Colombia: Rio Vichada
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Colorado
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Colorado River
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71-013004

Colorado River Basin
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Colorado, Northwestern
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Colorado: Boulder Cty.
71-006186
Colorado: Boulder Cty.: Left-Hand Creek
71-008334
Colorado: Colorado River
71-007960
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Colorado: Dolores River
71-007930
Colorado: Frying Pan River
71-012265
Colorado: Green River
71-013071
Colorado: Larimer Cty.
71-012423
Colorado: Larimer Cty.: Boyd Reservoir
71-012448
Colorado: Larimer Cty.: Parvin Lake
71-012868
Colorado: North Fork South Platte River
71-005921
Colorado: North St. Vrain Creek
71-001286
Colorado: Piceance Creek
71-001210
71-007874
71-010160
Colorado: Pitkin Cty.
71-011885
Colorado: Road Canyon Reservoir
71-011964
Colorado: South Platte River
71-001287
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71-012922
Colorado: St. Vrain River
71-012986
Colorado: Tenmile Creek
71-011899
71-011984
Colorado: Trout Creek
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71-010426
Colorado: Twin Lakes
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Colorado: Weld Cty.
71-006883
Colorado: White River
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Colorado: Yampa River
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Columbia River
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Connecticut
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Connecticut: Connecticut River
71-012945
Connecticut: Fairfield Cty.
71-009497
Connecticut: Farmington River
71-012971
Connecticut: Fishers Island Sound
71-005561
Connecticut: Linsley Pond
71-010049
Connecticut: Mystic River
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Connecticut: Thames River
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Coral Sea
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Costa Rica
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Cuba
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Cumberland River System
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Curacao
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Czechoslovakia
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Czechoslovakia: Klicava Reservoir
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Czechoslovakia: Rokytna River
71-007041
Czechoslovakia: Vah Basin
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Delaware
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Delaware River
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Delaware: Canary Creek
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Delaware: Delaware Bay
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Delaware: Delaware River
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Denmark
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Denmark: Faeroe Islands
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Denmark: Nissum Fjord
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Ecuador: Cuenca Basin
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El Salvador
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England
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England: Atlantic Ocean
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England: Blelham Tarn
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England: Cheshire
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England: Cornwall
71-010434
England: Cow Green Reservoir
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England: Devon: Farmworthy Reservoir
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England: Dorset: River Piddle
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England: Dorset: River Stour
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England: English Channel
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England: Essex
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England: Essex: Brodwell Brook
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England: Hudson's Tarn
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England: Lancashire: Morecambe Bay
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England: Leicestershire: Eye Brook
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England: Lower Medway Estuary
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England: Medway Estuary
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England: Mevagissey Bay
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England: River Avon
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England: River Eden: Moor House Natl. Fish Preserve
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England: River Lee
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England: River Severn
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England: River Stour
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England: River Wylye
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England: Severn Estuary
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Europe: Black Sea
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Finland: Atlantic Ocean
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Finland: Bothnian Bay
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Finland: Gulf of Finland
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Finland: Lake Iijarvi
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Finland: Lake Paijanne
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Finland: Oulu River
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Florida
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Florida: Dade Cty.
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Florida: Escambia Bay
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Florida: Florida Keys
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Florida: Gulf of Mexico
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Florida: Hillsborough Bay
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Florida: Hillsborough River
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Florida: Hutchinson Island
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Florida: Indian River Lagoon
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France: Lissuraga River
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France: Nivelle River
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France: Rhine River
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France: Rhone River
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France: River Lot
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France: The Estibere
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France: Verdon
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Georgia, Coastal
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Georgia: Apalachicola Drainage
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Georgia: Atlantic Intracoastal Waterway
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Georgia: Atlantic Ocean
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Georgia: Bibb Cty.: Lake Tobesofkee
71-005895
Georgia: Brunswick
71-010148
Georgia: Carroll Cty.: Dog River
71-008046
Georgia: Carroll Cty.: Lake Carroll
71-005297
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Georgia: Chattahoochee River
71-006214
Georgia: Clark Hill Reservoir
71-013061
Georgia: Colquit Cty.: Ochlocknee River
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Georgia: Columbus
71-010438
71-011952
Georgia: Coosa River
71-001495
71-008871
Georgia: Doboy Sound
71-005826
Georgia: Farm Ponds
71-012291
Georgia: Lake Blackshear
71-007169
Georgia: Lake Carroll
71-009593
Georgia: Lake Laurel
71-013009
Georgia: Lake Seminole
71-013104
Georgia: Lake Sidney Lanier
71-010334
Georgia: Lumpkin Cty.: Waters Creek
71-012247
Georgia: Ochlockonee River
71-008229
Georgia: Okefenokee Swamp
71-005604
71-010105
Georgia: Ossabaw Sound
71-012612
Georgia: Par Lake
71-007282
Georgia: Roaring Branch Creek
71-012073
Georgia: Sapelo Island
71-009886
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Georgia: Satilla River
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Georgia: Savannah River
71-006608
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71-012007
Georgia: Savannah River Estuary
71-011908
Georgia: Suches
71-010379
Georgia: Suwannee River
71-005604
Georgia: West Point Reservoir
71-006015
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Ghana
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Ghana: Lake Bosumtwi
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Great Lakes
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Greece
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Greece: Gulf of Athens
71-009005
Greece: Lake Aghios Vasilios
71-006448
71-007575
Greece: Lake Volvi
71-005780
Greece: Rhodes
71-008692
Greece: Saronikos Gulf
71-007020
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71-010407
Greece: Vistonis Lake
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Greenland
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Guam
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Guam: Pacific Ocean
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Guam: Tumon Bay
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Guatemala
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Gulf of Aden
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Gulf of Aqaba
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Gulf of California
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Gulf of Mexico
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Gulf of Mexico: Buccaneer Oil Field
71-010304
Gulf of Mexico: Campeche Bank
71-008180
Gulf of Mexico: Galveston Bay
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Gulf of Oman
71-007185
Gulf of Thailand
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Guyana
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Hawaii
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Hawaii: Honolulu
71-010297
Hawaii: Kaneohe Bay
71-005180
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Hawaii: Oahu
71-010384
Hawaii: Pacific Ocean
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Hispaniola
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Hong Kong
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Hong Kong: Plover Cove Reservoir
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Hudson Bay
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Hungary
71-010150
Hungary: Lake Balaton
71-008305
71-012837
Iceland
71-012253
Iceland: Lake Myvatn
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Iceland: River Laxa
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Idaho
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Idaho
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Idaho: Bear Lake
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71-008861
Idaho: Blackfoot River
71-010370
Idaho: Clearwater River
71-001764
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71-012269
Idaho: Columbia River
71-012967
Idaho: Dworshak Reservoir
71-001062
71-008259
Idaho: Emerald Creed
71-001233
Idaho: Henry's Lake
71-004767
Idaho: Lemhi River
71-005920
Idaho: Lewis Cty.: Winchester Lake
71-013030
Idaho: Palouse River
71-008041
Idaho: Panther Creek
71-010372
Idaho: Salmon River
71-006463
Idaho: Sand Spring Creek
71-012927
Idaho: Silver Creek
71-007852
Idaho: Snake River
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Idaho: South Fork Salmon River
71-006462
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Idaho: St. Joe River
71-012920
71-012992
Idaho: Teton Cty.: Teton River
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Illinois
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Illinois: Alton: Mississippi River
71-008242
Illinois: Big Creek
71-005779
Illinois: Big Rock Creek
71-006213
Illinois: Clear Creek
71-008053
Illinois: Cook Cty.: Joe's Pond
71-006098
Illinois: Crab Orchard Lake
71-009716
Illinois: Fox River
71-010477
Illinois: Hardin Cty.: Big Creek
71-008170
Illinois: Illinois River
71-008212
Illinois: Iroquois River
71-006839
Illinois: Johnson Cty.: Max Creek
71-005513
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Illinois: Kane Cty.: Elgin: Trout Park Nat. Preserve
71-008254
Illinois: Lake Shelbyville
71-006720
Illinois: Madison Cty.: Cahokia Creek Diversion Channel
71-001611
Illinois: Marion Cty.
71-013012
Illinois: Mississippi River
71-008212
Illinois: South Fork Saline River
71-010394
Illinois: Williamson Cty.: Lake of Egypt
71-012411
Illinois: Wolf Lake
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India
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India: Aligarh
71-000410
India: Allahabad
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India: Bay of Bengal
71-008777
India: Bhakra Reservoir
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India: Chilka Lake
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India: Cochin Backwater
71-006679
India: Dal Lake
71-006134
India: Ganga River
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India: Godavary Estuary
71-013315
India: Govindgarh Lake
71-013091
India: Gulf of Mannar
71-001703
India: Himalayas
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India: Hooghly Estuary
71-006197
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India: Hooghly-Matlah Estuary
71-005945
India: Indian Ocean
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India: Kulgarhi Reservoir
71-007511
India: Lake Pichhola
71-010515
India: Lake Pulicat
71-005796
India: Loni Reservoir
71-005783
India: Mahanadi Estuary
71-012804
India: Moplah Bay
71-008780
India: Narmada River
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India: Pulicat Lake
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India: River Cauvery
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India: River Ganges
71-006244
India: River Godavari
71-007477
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India: River Kali
71-006824
India: Sarda Sagar Reservoir
71-013095
India: Tungabhadra Reservoir
71-005499
71-006848
India: Veli Lake
71-006521
India: Yamuna River
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Indian Ocean
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Indian Ocean: Bay of Bengal
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Indian Ocean: Gulf of Aden
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Indian Ocean: Kathiawar Peninsula
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Indian Ocean: Kerguelen Islands
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Indian Ocean: South Africa
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Indian Ocean: South Moluccan Sea
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Indiana
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Indiana: Benton Cty.: Big Pine Creek
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Indiana: Carroll Cty.: Deer Ck.
71-006239
Indiana: La Porte Cty.
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Indiana: Little Center Lake
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Indiana: Michigan City
71-010108
Indiana: Mississinewa River
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Indiana: Palestine Lake
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Indiana: Pike Cty.: White River
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Indiana: Posey Cty.
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Indiana: Spring Mill State Park
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Indiana: Sullivan Cty.
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Indiana: Tippecanoe Cty.
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Indiana: Vigo Cty.
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Indiana: Wabash River
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Indiana: Washington Cty.: Blue River
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Indiana: White River
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Indiana: White River: Petersburg
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Indonesia
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Indonesia: Banda Sea
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Indonesia: Rawa Pening Lake
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Indonesia: Rawa Pening Lake
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Iowa: Big Creek Lake
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Iowa: Clear Lake
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Iowa: Des Moines River
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Iowa: Lake LaVerne
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Iowa: Lake Rathbun
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Iowa: Mahaska Cty.
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Iowa: Maquoketa River
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Iowa: Story Cty.
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Iowa: Upper Iowa River
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Iran
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Israel: Lake Kinneret
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Italy: Lago Trasimeno
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Italy: Lake Maggiore
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Italy: Ligurian Sea
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Italy: Po River
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Ivory Coast
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Ivory Coast: Lake Kossou
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Jamaica
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Jamaica: Discovery Bay
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Japan
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Japan: Atsuta River
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Japan: Chitose River
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Japan: Funka Bay
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Japan: Hakodate Bay
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Japan: Hokkaido
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Japan: Hokkaido: Atsuta River
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Japan: Honmura Bay
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Japan: Ise Bay
71-007223
Japan: Jinzu River
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Japan: Lake Biwa
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Japan: Lake Ikeda
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Japan: Lake Notoro
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Japan: Lake Shikotsu
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Japan: Mena River
71-006967
Japan: Nera Bay
71-000667
Japan: Nagara River
71-001679
Japan: Nishittappu River
71-001612
Japan: Okhotsk Sea
71-008234
Japan: Pacific Ocean
71-005981
Japan: Sea of Japan
71-007036
Japan: Sendai Bay
71-005771
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Japan: Seto Inland Sea
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Japan: Shibetsu River
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Japan: Suruga Bay
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Japan: Tokachi River
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Japan: Tokyo Bay
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Japan: Tsubusa River
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Japan: Utabetsu River
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Japan: Yahagi River
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Japan: Yurappu River
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Kansas
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Kansas: Doniphan Cty.: Wolf River
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Kansas: Greenwood Cty.: Hamilton Quarry
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Kansas: Johnson Cty.
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Kansas: Kansas River
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Kansas: La Cygne Lake
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Kansas: Neosho River
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Kansas: Pottawatomie Cty.: Lost Creek
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Kansas: Short Creek
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Kentucky
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Kentucky: Barkley Lake
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Kentucky: Big Muddy Creek
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Kentucky: Calloway Cty.: Russells Chapel Spring
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Kentucky: Cumberland River
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Kentucky: Daniel Boone Natl. Forest
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Kentucky: Fayette Cty.: Steeles Run
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Kentucky: Ferguson Creek
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Kentucky: Goose Creek
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Kentucky: Herrington Lake
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Kentucky: Jefferson Cty.: Goose Creek
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Kentucky: Kentucky Lake
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Kentucky: Kentucky River
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Kentucky: Lake Cumberland
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Kentucky: Lake Wilgreen
71-008953
Kentucky: Madison Cty.: Silver Creek
71-007668
Kentucky: Meade Cty.: Doe Run
71-007595
Kentucky: Ohio River
71-006148
71-006829
Kentucky: Oldham Cty.: South Fork Harrods Creek
71-007088
Kentucky: Rough River Lake
71-005655
71-005656
71-005682
Kentucky: Shelby Cty.: Brashears Creek
71-005482
Kentucky: Spencer Cty.: Brashears Creek
71-005482
Kentucky: Trimble Cty.: Barebone Creek
71-001985
Kentucky: Trimble Cty.: Ohio River
71-007173
Kentucky: Warren Cty.: Ivy Creek
71-005825
71-006503
Kenya
71-006777
Kenya: Lake Kamburu
71-005942
Kenya: Lake Naivasha
71-001232
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Kenya: Lake Nakuru
71-006737
Kenya: Lake Rudolf
71-012834
Kenya: Lake Victoria
71-005803
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Kenya: Nzoia River
71-012915
Lake Erie
71-001055
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71-001092
71-001120
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71-001123
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71-012087
71-012390
71-012677
71-012838
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71-012876
Lake Erie: Long Point Bay
71-006535
71-012090
Lake Erie: Nanticoke
71-010309
Lake Huron
71-006127
71-008423
71-008925
71-009502
71-009956
71-009958
71-010022
71-010648
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Lake Huron: Douglas Point
71-010309
Lake Huron: Douglas Point Generating Station
71-012688
Lake Huron: Saginaw Bay
71-008333
Lake Michigan
71-001212
71-001246
71-001303
71-001311
71-001314
71-002361
71-002995
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Lake Michigan: Green Bay
71-006915
Lake Michigan: Point Beach Nuclear Plant
71-006697
Lake Ontario
71-001085
71-001171
71-001326
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71-007009
71-007011
71-007669

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Lake Ontario
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71-010221
71-010322
71-010906
71-011192
71-012178
71-012821
71-012838
71-012895
Lake Ontario: Bay of Quinte
71-008357
Lake St. Clair
71-010450
Lake Superior
71-001415
71-004318
71-005995
71-006099
71-006374
71-006561
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71-010021
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71-010245
71-010346
71-010474
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Lake Superior: Nipigon Bay
71-010047
71-010048
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71-010222
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Lake Tanganyika
71-005529
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Lake Victoria
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Liberia
71-005786
Ligurian Sea
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Louisiana
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Louisiana: Atchafalaya River
71-007795
Louisiana: Bayou Sara
71-006963
Louisiana: Caminada Bay
71-008079
Louisiana: Chenier Plain Coastal Area
71-007881
71-007882
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Louisiana: Gulf of Mexico
71-001149
Louisiana: Lafourche Parish
71-001260
Louisiana: Lake Pontchartrain
71-006859
Louisiana: Lower Mississippi Basin
71-007795
Louisiana: Pearl River
71-007397
71-010045
Louisiana: Rockefeller Wildlife Refuge
71-006082
71-006457
Louisiana: Toledo Bend
71-006656

Madagascar
71-007560
Maine
71-004578
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71-006674
71-008657
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71-010094
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Maine: Atlantic Ocean
71-008326
Maine: Eagle Lake
71-012166
Maine: Floods Pond
71-005683
71-006673
Maine: Gulf of Maine
71-005744
Maine: Hancock Cty.: Giles Pond
71-012347
Maine: Penobscot River
71-006466
71-006616
71-012345
71-012930
Maine: Penobscot River Estuary
71-006615
71-006655
71-006672
Maine: Piscataquis Cty.: Big Bennett Pond
71-013043
Maine: Searsport
71-010296
Maine: Sebago Lake
71-012845
Malagasi Republic: Lake Aloatra
71-007559
Malawi: Lake Malawi
71-000537
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71-008807
Malawi: Shire Valley
71-005882
Malaya
71-006498
Malaysia
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Marshall Islands
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Maryland
71-007853
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71-013161
Maryland: Baltimore Harbor
71-011473
Maryland: Conococheague Creek
71-008036
Maryland: Patuxent River
71-000037
Maryland: Wicomico Cty.: Wicomico River
71-009354
Massachusetts
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Massachusetts: Acushnet River
71-005087
Massachusetts: Beverly-Salem Harbor
71-007954
Massachusetts: Boston Harbor
71-013227
Massachusetts: Buzzards Bay
71-010177
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71-010454
Massachusetts: Cape Cod
71-004751
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Massachusetts: Congamond Lake
71-006662
Massachusetts: Connecticut River
71-001999
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Massachusetts: Connecticut River: Holyoke Dam
71-012703
Massachusetts: Dartmouth
71-007926
Massachusetts: Mill River
71-006480
Massachusetts: Parker River
71-006032
Massachusetts: Parker River Estuary
71-006054
Massachusetts: Pleasant Bay
71-007846
Massachusetts: Quabbin Reservoir
71-013107
Massachusetts: Slocum River Estuary
71-006884
Mediterranean Area
71-001861
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Mediterranean Area: Aegean Sea
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Mediterranean Sea
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Mexico
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Mexico: Baja California
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Mexico: Baja California: Pacific Ocean
71-007847
Mexico: Chihuahua
71-008791
Mexico: Chihuahuan Desert
71-008696
Mexico: Colima: Rio Armeria
71-007804
Mexico: Gulf of California
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Mexico: Jalisco: Rio Grande de Santiago
71-007770
Mexico: Nuevo Leon: El Potosi
71-008419
Mexico: Pacific Ocean
71-007697
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Mexico: Rio Grande Basin
71-008528
Mexico: Rio Grande River
71-008628
Mexico: Rio Mayo
71-008065
Mexico: Rio Panuco
71-008630
Mexico: Rio Teuchitlan
71-008643
Mexico: Rio Verde
71-008529
Mexico: Rio Yaqui
71-007913
71-008065
Mexico: Sonora
71-008073
Mexico: Sonora: Presa de Novillo Reservoir
71-009767
Mexico: Tamaulipas
71-006205
Mexico: Tamesi-Panuco Basin
71-008629
Mexico: Vera Cruz
71-008589
Mexico: Yucatan
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Michigan
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Michigan
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Michigan: Au Sable River
71-008407
71-012913
Michigan: Barry Cty.: Daggett Lake
71-012383
Michigan: Barry Cty.: Lawrence Lake
71-006626
Michigan: Barry Cty.: Long Lake
71-012382
Michigan: Chippewa Cty.: Soldiers Lak
71-007584
Michigan: Elm River
71-001272
Michigan: Gogebic Cty.
71-012242
Michigan: Grand Traverse Cty.
71-010012
Michigan: Huron River
71-012299
Michigan: Kalamazoo Cty.: Wintergreen Lake
71-010290
Michigan: Katherine Lake
71-005933
Michigan: Lake Gogebic
71-006100
Michigan: Lake St. Clair
71-006002
71-011022
Michigan: Lake Superior
71-012471
Michigan: Lawrence Lake
71-007345
Michigan: Ludington Pumped Storage Powe Plant
71-012705
Michigan: Manistee Lake
71-012562
Michigan: Marquette
71-011216
Michigan: Marquette Cty.: Big Garlic River
71-001749
71-006666
Michigan: Marquette Cty: Big Garlic Riv
71-005726
Michigan: Mecosta Cty.
71-011595
Michigan: North Branch Au Sable River
71-006756
Michigan: Ocqueoc River
71-001750
Michigan: Ogemaw Cty.: Jewett Lake
71-012459
Michigan: Otsego Cty.: Club Stream
71-001227
Michigan: Pigeon River
71-001226
Michigan: Platte River
71-006536
Michigan: Roscommon Cty.
71-007110
Michigan: Saline River Tributary
71-010771
Michigan: Spring Brook
71-005562
Michigan: Torch Lake
71-010278
Michigan: Washtenaw Cty.
71-007212
Michigan: Washtenaw Cty.: Fleming Creek
71-009626
Minnesota
71-001236
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71-012871
Minnesota: Cannon River
71-005580
Minnesota: Cass Cty.: Mabel Lake
71-012863
Minnesota: Lake Bemidji
71-006635
Minnesota: Lake of the Woods
71-006102
71-007271
71-008433
Minnesota: Mary Lake
71-006741

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Minnesota: Mary Lake
71-006742
Minnesota: Meeker Cty.: Lake Erie
71-012290
Minnesota: Minnesota River
71-005573
71-008274
Minnesota: Mississippi River
71-002498
Minnesota: Rainy Lake
71-008314
Minnesota: Red Lakes
71-006125
Minnesota: Scott Cty.: Carls Lake
71-012832
Minnesota: Shagawa Lake
71-007271
Minnesota: Voyageurs Natl. Park
71-012146
Minnesota: Wilson Lake
71-012297
Minnesota: Wright Cty.: Lake Mary
71-012290
Mississippi
71-000241
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Mississippi River
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Mississippi River Basin
71-007768
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71-008465
Mississippi River Basin, Central
71-008798
Mississippi: Grenada Reservoir
71-001196
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Mississippi: Gulf of Mexico
71-009809
Mississippi: Hancock Cty.: Catahoula Creek
71-005646
Mississippi: Hancock Cty.: Jourdan River
71-006970
71-007396
Mississippi: Horn Island
71-008078
Mississippi: Lake Okatibbee
71-011932
Mississippi: Luxapalila River
71-011863
Mississippi: Pearl River
71-007397
71-010045
Mississippi: Pearl River Cty.: Jourdan River
71-006970
Mississippi: Pickwick Reservoir
71-005097
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71-007491
Mississippi: Strong River
71-007780
Mississippi: Tombigbee River
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Missouri
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Missouri River
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71-012158
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Missouri River Basin
71-007805
71-013118
Missouri River Basin Reservoirs
71-013119
Missouri River Basin, Upper
71-007959
Missouri River Basin: Montana
71-012972
Missouri, Northern
71-012401
Missouri, Northwestern
71-008074
Missouri: Bennett Spring
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Missouri: Big Buffalo Creek
71-012984
Missouri: Big River
71-001616
71-008067
Missouri: Black River
71-012949
Missouri: Bull Shoals Reservoir
71-008294
Missouri: Cane Creek
71-008288
Missouri: Cedar Creek
71-010348
Missouri: Courtois Creek
71-005956
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71-012156
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71-012947
Missouri: Elk River
71-001060
Missouri: Forrest Lake
71-005987
Missouri: Greene Cty.: James River
71-005608
Missouri: James River
71-001060
Missouri: Lake of the Ozarks
71-011894
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Missouri: Lake Taneycomo
71-012280
Missouri: Middle Fabius River
71-011963
Missouri: Mississippi River
71-012939
Missouri: Missouri River
71-011929
71-012983
Missouri: Osage River Basin
71-005790
Missouri: Pomme de Terre Lake
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Missouri: Pony Express Lake
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Missouri: Spring River
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Missouri: Thomas Hill Reservoir
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Montana
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Montana, Southeastern
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Montana: Big Spring Creek
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Montana: Canyon Ferry Reservoir
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Montana: Colstrip
71-010378
Montana: East Gallatin River
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Montana: Flathead Lake
71-001064
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Montana: Gallatin River
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Montana: Kootenai River
71-007689
Montana: Madison River
71-012278
71-012994
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Montana: Missouri River Basin
71-012972
Montana: Prickly Pear Creek
71-012115
Montana: Rosebud Creek
71-010125
71-011869
Montana: St. Regis River
71-011995
Montana: Tongue River
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Montana: Yellowstone River
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Morocco
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Mozambique: Lake Cabora Bassa
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Nebraska
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Nebraska, Southeastern
71-001316
Nebraska: Adams Cty.: 32 Mile Creek
71-008257
Nebraska: Brown Cty.: Bone Creek
71-007255
Nebraska: Garden Cty.: Island Lake
71-012791
Nebraska: Keith Cty.
71-009267
Nebraska: Lake McConaughy
71-001409
71-011761
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Nebraska: Lancaster Cty.: Branched Oak Lake
71-007093
71-007094
Nebraska: Lewis and Clark Lake
71-006486
71-007603
71-013124
Nebraska: Missouri River
71-007486
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Nebraska: North Platte River
71-011761
Nebraska: Salt Creek
71-008027
Nebraska: Sandhills Lakes
71-012880
Nebraska: South Platte River
71-009316
Nebraska: Thirty-two Mile Creek
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Netherlands
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Netherlands Antilles
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Netherlands: Tjeukemeer
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Nevada
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Nevada: Clark Cty.
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Nevada: Clark Cty.: Moapa River
71-007806
Nevada: Colorado River
71-007027
Nevada: Death Valley
71-008066
Nevada: Goshute Creek
71-011991
Nevada: Jersey Valley
71-008660
Nevada: Lake Mead
71-001052
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Nevada: Lake Mohave
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Nevada: Lake Tahoe
71-012435
Nevada: Nye Cty.: Devil's Hole
71-007118
Nevada: Pyramid Lake
71-002422
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71-006365
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71-008617
71-011746
Nevada: Truckee River
71-006582
Nevada: Virgin River
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New Caledonia
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New England
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New England: Atlantic Ocean
71-007903
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New Hampshire
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New Hampshire: Bellamy River
71-009821
New Hampshire: Great Bay Estuary
71-008914
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71-009543
New Hampshire: Hubbard Brook
71-001147
New Hampshire: Johnson Creek
71-009754

New Hampshire: Kezar Lake
71-011955
New Hampshire: Mirror Lake
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New Hampshire: Oyster River
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New Jersey
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New Jersey: Atlantic Ocean
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New Jersey: Barnegat Bay
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New Jersey: Deal Lake
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New Jersey: Delaware Bay
71-009763
New Jersey: Delaware River
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New Jersey: Little Egg Inlet
71-008068
New Jersey: Morris Cty.: Ryan's Ponds
71-013036
New Jersey: New York Bight
71-010524
71-013256
New Jersey: Newark Bay
71-008179
New Jersey: Raritan Bay
71-008989
New Jersey: Round Valley Reservoir
71-012464
New Jersey: Sandy Hook Bay
71-008276
New Jersey: Stone Harbor
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New Mexico
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New Mexico, Northwestern
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New Mexico: Cibola Natl. For.
71-013001
New Mexico: Elephant Butte Lake
71-005999
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New Mexico: Pecos River
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New Mexico: San Juan River
71-008072
New Mexico: Tularosa Basin
71-008695
New South Wales
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New York
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New York: Adirondack Lakes
71-010145
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New York: Allegheny Cty.
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New York: Allegheny River
71-005768
New York: Arthur Kill
71-007763
New York: Atlantic Ocean
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New York: Cayuga Lake
71-005503
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New York: Cayuga-Seneca Canal
71-010389
New York: Cazenovia Lake
71-005074
New York: Conesus Lake
71-009791
New York: Erie Cty.
71-012143
71-012144
New York: Erie Cty.: Derby Brook
71-008063
New York: Finger Lakes
71-000026
New York: Fire Island Inlet
71-005258
New York: Goose Creek
71-011973
New York: Great Lakes
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New York: Hudson River
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New York: Hudson River Estuary
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New York: Lake Chautauqua
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New York: Lake George
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New York: Lewis Cty.: South Sandy Creek
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New York: Long Island
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New York: Long Island Sound
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New York: Mohawk River
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New York: Montauk Point
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New York: Niagara River
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New York: Westchester Cty.: Lake Waccabuc
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New Zealand: Ashley River
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New Zealand: Bay of Plenty
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New Zealand: Burlings Stream
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New Zealand: Glentui River
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New Zealand: Lake Chalice
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New Zealand: Lake Christabel
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New Zealand: Lake Ellesmere
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New Zealand: Lake Okaihau
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New Zealand: Lake Pounui
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New Zealand: Lake Rotorua
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New Zealand: Lyttelton Harbour
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New Zealand: Makara Stream
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New Zealand: Mathias River
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New Zealand: North Island
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New Zealand: Pacific Ocean
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New Zealand: Selwyn River
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New Zealand: South Westland
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New Zealand: Waikato River
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New Zealand: Wainuiomata River
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New Zealand: Woolly Creek
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Nicaragua
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Nicaragua: Lake Jiloa
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Nigeria
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Nigeria: Lake Kainji
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Nigeria: Lekki Lagoon
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Nigeria: Swashi River
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North America
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North America: Arctic
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North America: Pacific Coast
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North Carolina
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North Carolina: Albemarle Sound
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North Carolina: Atlantic Ocean
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North Carolina: Brevard
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North Carolina: Cape Fear Estuary
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North Carolina: Cape Fear River
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North Carolina: Carteret Cty.
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North Carolina: Croatan Natl. For.
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North Carolina: Currituck Sound
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North Carolina: Great Smoky Mountains Natl. Park
71-011865
North Carolina: Hoggard Mill Creek
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North Carolina: Lake Hyco
71-010261
North Carolina: Lake Norman
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North Carolina: Lake Raleigh
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North Carolina: Lake Waccamaw
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North Carolina: Little River
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North Carolina: New River
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North Carolina: Newport River Estuary
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North Carolina: Onslow Bay
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North Carolina: Tar Landing Bay
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North Dakota
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North Dakota: Benson Cty.: Wood Lake
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North Dakota: Lake Sakakawea
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North Dakota: Rolette Cty.: Gravel Lake
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North Dakota: Sheyenne River
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North Dakota: Wood Lake
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North Sea
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North Sea: Scagerac Sea
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Northern Ireland
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Northern Ireland: Foyle
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Northern Ireland: Lough Neagh
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Norway
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Norway: Lake Ovre Heimadalsvatn
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Norway: Lake Oyungen
71-005997
Norway: Lake Tveitevatn
71-009106
Norway: Lindaspollene
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Norway: Neiden River
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Norway: North Sea
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Norway: Oslofjorden
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Norway: Skjomen
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Norway: Vardnes River
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Ohio
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Ohio River
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Ohio, Southeastern
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Ohio: Acton Lake
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Ohio: Chagrin River
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Ohio: Champaign Cty.: Anderson Creek
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Ohio: Davis-Beese Nuclear Power Stn.
71-010388
Ohio: Four Mile Creek
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Ohio: Franklin Cty.: Grant's Run
71-006481
71-006482
Ohio: Green Creek
71-008228
Ohio: Hoover Reservoir
71-013093
Ohio: Lake Cty.: East Brance Chagrin River
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Ohio: Lake Erie
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Ohio: Little Auglaize River
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Ohio: Lucas Cty.
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Ohio: Lucas Cty.: Tenmile Creek
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Ohio: Mosquito Lake
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Ohio: Olentangy River
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Ohio: Ottawa River
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Ohio: Ottoville
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Ohio: Portage Cty.
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Ohio: Portage River
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Ohio: Pymatuning Lake
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Ohio: Richmond Cty.: Cedar Fork Creek
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Ohio: Salt Creek
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Ohio: Toledo
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Ohio: Wayne Natl. For.
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Ohio: West Twin Lake
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Ohio: Wood Cty.
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Okinawa
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Oklahoma
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Oklahoma: Arbuckle Lake
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Oklahoma: Arkansas River
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Oklahoma: Boomer Lake
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Oklahoma: Eufaula Reservoir
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Oklahoma: Ham's Lake
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Oklahoma: Illinois River
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Oklahoma: Johnson Cty.: Pennington Creek
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Oklahoma: Keystone Reservoir
71-006836
Oklahoma: Kiamichi River
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Oklahoma: Lake Carl Blackwell
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Oklahoma: Lake Eufala
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Oklahoma: Lake Texoma
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Oklahoma: Lake Thunderbird
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Oklahoma: Little River
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Oklahoma: Logan Cty.: Cimarron River
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Oklahoma: Marshall Cty.: Brier Creek
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Oklahoma: McCurtain Cty.: Mountain Fork River
71-012123
Oklahoma: Mill Creek
71-007737
Oklahoma: Muddy Boggy River
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Oklahoma: North Canadian River
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Oklahoma: Red River Drainage
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Oklahoma: South Canadian River
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Oklahoma: West Cache Creek
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Oregon
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Oregon: Antelope Reservoir
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Oregon: Cline's Pond
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Oregon: Columbia River
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Oregon: Columbia River Estuary
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Oregon: Continental Shelf
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Oregon: Coos Bay
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Oregon: Elk River
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Oregon: Klamath River
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Oregon: Mill Creek
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Oregon: Pacific Ocean
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Oregon: Rogue River
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Oregon: Snake River
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Oregon: Willamette River
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Oregon: Yaquina Bay
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Oregon: Yaquina Estuary
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Pacific Ocean, Bering Sea
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Pacific Ocean, California Coast
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Pacific Ocean, Eastern
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Pacific Ocean, Indo-West
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Pacific Ocean: Australia
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Pacific Ocean: Marshall Islands
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Pacific Ocean: Mexico
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Pacific Ocean: New Zealand
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Pacific Ocean: Okhotsh Sea
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71-010265
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71-007707
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71-010461
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71-007319
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71-010238
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71-001496
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71-007097
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Pennsylvania: Northampton Cty.: Saucon Creek
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USSR: Aldan River
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USSR: Amu Dar'ya
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USSR: Amur Basin
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USSR: Amur Bay
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USSR: Amur Estuary
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USSR: Amur River
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USSR: Anabar River
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USSR: Anadyr River
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USSR: Aral Sea
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USSR: Argun River
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USSR: Azov Sea
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USSR: Baltic Sea
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USSR: Barents Sea
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USSR: Bering Sea
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USSR: Black Sea
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USSR: Bukhtarma Reservoir
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USSR: Caspian Sea
71-004235
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71-007143
USSR: Chirmurgan Reservoir
71-005473
USSR: Chukotsk Peninsula
71-007785
USSR: Chulym River
71-005859
USSR: Courland Lagoon
71-001859
71-004216
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USSR: Dagestan
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USSR: Danube River
71-005697
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USSR: Dnieper River
71-013005
USSR: Don River
71-006807
USSR: Donets River
71-012993
USSR: Gulf of Riga
71-006444
USSR: Ili River
71-006359
71-006432
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USSR: Iriklinskoye Reservoir
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USSR: Irtysh River Basin
71-005789
USSR: Irtysh-Karaganda Canal
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USSR: Ivan'kovskoye Reservoir
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USSR: Kakhovka Reservoir
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USSR: Kamchatka
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USSR: Kamchatka Bay
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USSR: Kamchatka River
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USSR: Kamchatka: Bol'shaya River
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USSR: Kamchatka: Lake Nachikin
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USSR: Kamyshlybash Lakes
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USSR: Kapchagay Reservoir
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USSR: Karelian Lake
71-003422
USSR: Kazakh: Aral Sea
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USSR: Kazakhastan Province
71-004753
USSR: Kazakhstan
71-002840
USSR: Kazakhstan: Nura River Basin
71-007830
USSR: Khorezm Province
71-005464
USSR: Kola Peninsula
71-004952
71-008991
USSR: Korral Lake
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USSR: Krasnoyarsk Territory
71-007997
USSR: Kuban Lagoons
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USSR: Kuban River
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USSR: Kura River
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USSR: Kuril Islands
71-005468
USSR: Kursha Bay
71-006446
USSR: Kurskii Lagoon
71-005015
USSR: Kuybyshev Reservoir
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USSR: Kuyto Lakes
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USSR: Ladoga Lake
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USSR: Lake Agata
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USSR: Lake Azabach'ye
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USSR: Lake Baikal
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USSR: Lake Dal'neye
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USSR: Lake Frolikha
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USSR: Lake Gusinoye
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USSR: Lake Il'men'
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USSR: Lake Issyk-Kul
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USSR: Lake Khanka
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USSR: Lake Khoshkin'yarvi
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USSR: Lake Krivoye
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USSR: Lake Kuben
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USSR: Lake Ladoga
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USSR: Lake Onega
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71-005946
USSR: Lake Uyeginskoye
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USSR: Lena River
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71-002426
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71-007049
USSR: Man'ya River
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71-007355
USSR: Nadym River
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USSR: Noril'sk Lakes
71-005818
USSR: Ob River
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USSR: Okhotsk Sea
71-008181

USSR: Ozernaya River
71-006573
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USSR: Pskovsko-Chudskoe Lake
71-012770
USSR: Rybinsk Reservoir
71-004307
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USSR: Sakhalin
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71-006595
71-006952
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USSR: Saratov Reservoir
71-005692
71-007352
USSR: Sea of Azov
71-005694
71-006019
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71-007114
71-008299
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USSR: Siberia
71-007497
71-011724
USSR: Siberia: Tanama River
71-005793
USSR: Siberian Rivers
71-006147
USSR: Syr Darya
71-005478
USSR: Syr-Dar'ya River
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71-006559
USSR: Taganrog Gulf
71-007113
USSR: Tanama River
71-007580
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71-007691
USSR: Terek Delta
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USSR: Tsimlyansk Reservoir
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71-006009
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USSR: Uglich Reservoir
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71-006063
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71-001958
USSR: Vilyuy Reservoir
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USSR: Yenisey
71-008835
USSR: Yenisey River
71-006367
USSR: Yuribey River
71-004848

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71-013474
Utah, Southern
71-013467
Utah: Bear Lake
71-005832
71-008861
Utah: Colorado River
71-008043
Utah: Flaming Gorge Reservoir
71-001204
71-001344
71-005861
71-007303
71-007342
71-013112
71-013127
Utah: Great Salt Lake
71-001366
Utah: Green River
71-013071
Utah: Joes Valley Reservoir
71-008341
71-008341
Utah: Lake Powell
71-001216
71-001341
71-006669
71-006976
71-007102
71-012159
71-012433
Utah: Logan River
71-005910
71-012422
Utah: San Rafael River
71-008044
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71-005582
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71-009696
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71-013309
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71-007444
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71-006773
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71-009099
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71-009499
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71-000695
71-005665
71-007392
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71-010300
71-012186
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71-010344
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71-001201
71-006057
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71-012002
71-012162
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71-005801
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71-007953
Virginia: Chestnut Creek
71-010909
Virginia: Chickahominy Reservoir
71-000002
71-000003
71-000041
71-010599
Virginia: Chincoteague Bay
71-009836
Virginia: Claytor Lake
71-007040
71-013079
Virginia: Clinch River
71-008032
71-010528
Virginia: East River
71-008218

Virginia: Fairfax Cty.
71-007974
Virginia: Holiday Creek
71-007678
Virginia: Hopewell: James River
71-010400
Virginia: James River
71-002067
71-004713
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71-007328
71-008017
71-010490
Virginia: Louisa Cty.: Lake Anna
71-001285
Virginia: Lynnhaven Bay
71-008183
Virginia: New River
71-001219
71-007256
71-008134
71-010114
71-010440
71-010441
71-010442
71-012573
Virginia: North Fork Holston River
71-010198
71-010199
Virginia: Piankatank River
71-008060
Virginia: Plum Creek
71-010288
Virginia: Rappahannock River
71-004769
Virginia: Roanoke River
71-001275
71-004641
Virginia: Smith Mountain Lake
71-001321
71-001348
71-007192
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71-012056
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71-013082
Virginia: Smith Mountain Pump Storage Project
71-013495
Virginia: South Fork Holston River
71-007952
Virginia: South Fork Shenandoah
71-010227
Virginia: York River
71-006667
71-007311
Virginia: York River Channel
71-006667
Virginia: York River Estuary
71-005527
71-005528
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71-004432
71-004572
71-005962
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71-009272
71-009403
71-010138
Wales: Llyn Dwythwch
71-007174
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Wales: Llyn Tegid
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Wales: River Dee
71-007673
Wales: River Wye
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71-010513
Wales: Taff Bargoed
71-010415
Wales: Upper Wye
71-006046
Washington
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Washington, Coastal
71-001107
71-009170
Washington: Banks Lake
71-012084
Washington: Columbia River
71-001491

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Washington: Columbia River
71-005552
71-006631
71-006841
71-007887
71-009247
71-009501
71-009616
Washington: Columbia River Estuary
71-008075
Washington: Crab Creek
71-008039
71-008039
Washington: Duwamish River Estuary
71-009800
Washington: Grant Cty.: Banks Lake
71-012084
71-013114
71-013114
Washington: Hard Creek
71-007741
Washington: Henderson Inlet
71-000628
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Washington: Lake Washington
71-005907
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71-005925
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71-006138
71-006866
71-006885
71-006887
71-007227
71-012846
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71-012684
Washington: Pacific Ocean
71-005976
71-005977
71-005978
71-006249
71-007835
Washington: Palouse River
71-008041
Washington: Puget Sound
71-001298
71-005558
71-005906
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71-012103
71-012438
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71-009980
Washington: Skagit River
71-011939
Washington: Snake River
71-006623
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71-009616
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71-012694
Washington: Wapato Lake
71-006375
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71-010498
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71-009040
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71-006072
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71-008757
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71-010132
71-010154
71-011892
West Germany: Elbe River
71-009869
West Germany: Lake Constance
71-006629
71-008347
West Germany: Lower Elbe
71-009868
West Germany: Starnberger See
71-012560
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71-006123
West Virginia
71-006925
71-007818
71-011771
West Virginia: Braxton Cty.: Sutton Reservoir
71-007062
West Virginia: East River
71-008218
West Virginia: Fernow Experimental Forest
71-013476
West Virginia: Gauley River
71-007925
West Virginia: Grant Cty.
71-000097
West Virginia: Grant Cty.: Mt. Storm Reservoir
71-008381
West Virginia: Greenbrier Cty.: Buckeye Creek Cave
71-002062
West Virginia: Greenbrier Cty.: Lake Sherwood
71-006161
West Virginia: Greenbrier River
71-007924
71-009903
West Virginia: Kanawha River
71-010281
West Virginia: Monongahela River Basin
71-004807
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West Virginia: Monroe Cty.: Moncove Lake
71-001094
71-007349
West Virginia: Nicholas Cty.: Summersville Lake
71-001322
West Virginia: Ohio River
71-007443
West Virginia: Randolph Cty.: Glady Fork
71-001494
West Virginia: Randolph Cty.: Spruce Knob Lake
71-001115
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West Virginia: Randolph Cty: Spruce Knob Lake
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West Virginia: Summers Cty.: Bluestone Reservoir
71-007062
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West Virginia: Wayne Cty.: East Lynn Lake
71-006430
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West Virginia: Wayne Cty.: Lynn Creek
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Wisconsin, Southeastern
71-009482
Wisconsin: Barron Cty.: Red Cedar River
71-009989
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Wisconsin: Bayfield Cty.
71-011572
Wisconsin: Black Earth Creek
71-010054
Wisconsin: Brule River
71-005356
71-012167
Wisconsin: Chippewa River
71-003069
Wisconsin: Dane Cty.: Lake Mendota
71-006647
Wisconsin: Dane Cty.: Lake Monona
71-008910
Wisconsin: Dane Cty.: Roxbury Creek
71-007109
Wisconsin: Forest Cty.: Bug Lake
71-011613
Wisconsin: Iowa Cty.: Trout Creek
71-012389
Wisconsin: Lake Mendota
71-005117
71-007442
Wisconsin: Lake Michigan
71-006496
Wisconsin: Lake Wingra
71-000008
71-001349
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Wisconsin: Lake Winnebago
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71-006703
Wisconsin: Lawrence Creek
71-006305
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Wisconsin: Madison Lakes
71-001176
Wisconsin: Marathon Cty.: Big Eau Pleine Reservoir
71-013075
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Wisconsin: Murphy Flowage
71-012214
Wisconsin: Pallette Lake
71-006612
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Wisconsin: Pike River
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Wisconsin: Plover River
71-006073
71-006074
Wisconsin: Portage
71-010247
Wisconsin: Portage Cty.: Buena Vista Marsh
71-011959
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71-012070
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71-006074
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71-012216
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71-012285
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71-006441
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71-012176
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71-006011
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71-004780
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71-012881
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71-009685
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71-001204
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71-012832
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71-007710
Alabama: Cedar Creek
71-008076
Alabama: North River
71-007948
Alaska
71-008038
71-008111
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71-008189
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71-007911
Arabian Sea
71-008100
Arctic Ocean: Beaufort Sea
71-013461
Arizona: Rio Yaqui
71-007913
Arkansas: Buffalo River
71-007779
Arkansas: Caddo River
71-007821
Arkansas: Cane Creek
71-008288
Arkansas: Crowley's Ridge
71-007861
Arkansas: Eleven Point River
71-007955
Arkansas: Fourche River
71-007754
Arkansas: Izard Cty.: Piney Creek
71-008037
Arkansas: Moro Creek
71-008163
Arkansas: Ouachita River
71-007907
Arkansas: Randolph Cty.
71-007755
Arkansas: Stone Cty.: Sylamore Creek
71-007854
Arkansas: Ten Mile Creek
71-007951
Atlantic Ocean, North
71-007730
71-007814
71-007851
71-007859
71-007902
71-007922
71-008260
Atlantic Ocean, North: Canary Current
71-007966
Atlantic Ocean, North: Norfolk Canyon
71-008264
Atlantic Ocean, North: Norwegian Sea
71-008093
Atlantic Ocean, North: South Atlantic Bight
71-008265
71-008266
71-008267
Atlantic Ocean, South: Scotia Sea
71-008117
Atlantic Ocean: Georges Bank
71-007793
Atlantic Ocean: Gulf of Maine
71-007793

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Atlantic Ocean: New York
71-007917
Atlantic Ocean: New York Bight
71-008277
71-013256
Australia: Blackwood River Estuary
71-008009
Australia: Geographe Bay/Bunbury
71-008256
Australia: Queensland: Serpentina Creek
71-006690
Australia: Queensland: Trinity Bay
71-007742
Australia: Shark Bay
71-008010
Australia: Victoria
71-008283
Australia: Victoria: Murray River
71-007774
Australia: Victoria: Tullaroop Creek
71-012956
Austria: Polzberg Bei Lunz
71-007888
Barbados
71-008137
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71-008594
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71-007788
Brazil
71-008022
California
71-007933
71-007938
71-008055
California/Exotic Species
71-012439
California, Southern
71-008056
California: Alameda Creek
71-007680
71-008187
California: Alamitos Bay
71-007687
California: Anaheim Bay
71-008001
71-008007
California: Coyote Creek
71-007680
71-008187
California: Death Valley
71-008066
California: Monterey Bay
71-007693
71-007998
71-007999
California: Pacific Current
71-007916
California: Pacific Ocean
71-007847
71-007932
California: Pajaro River
71-008206
California: Santa Clara River
71-007722
Canada: British Columbia
71-008111
Canada: Gulf of St. Lawrence
71-007983
Canada: Hudson Bay
71-008083
Canada: James Bay
71-008083
Canada: Labrador
71-013282
Canada: Newfoundland
71-013282
Canada: Northumberland Strait
71-007841
Canada: Ontario: Quetico Provincial Park
71-007808
Canada: St. Lawrence River Estuary
71-007679
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71-007812
Caspian Sea
71-007971
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71-008577
Cebidichthyidae
71-008826
Centropomus
71-008605
Chesapeake Bay
71-008081
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71-007752
Cichlidae
71-007701
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71-008000
Colorado River
71-007834
Colorado River Basin
71-007696
Colorado: Dolores River
71-007930
Colorado: Piceance Creek
71-007874
Colorado: South Platte River
71-012922
Colorado: White River
71-007777
Colorado: Yampa River
71-007777

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Fish Lists/Keys
Colorado: Yampa River
71-007930
Columbia River
71-007886
Columbia River Estuary
71-008075
Connecticut
71-008243
Connecticut: Thames River
71-012955
Cottidae: USSR: Lake Agata
71-007989
Czechoslovakia
71-007929
Dactyloscopidae
71-008543
Delaware
71-008002
71-008042
Delaware: Delaware River Estuary
71-008260
Exotic Species/Texas: Bexar Cty.
71-007939
Florida
71-007802
71-008493
Florida/Exotic Species
71-007802
Florida: Apalachicola River
71-008289
Florida: Dade Cty./Exotic Species
71-007927
Florida: Hillsborough Bay
71-008126
Florida: Hutchinson Island
71-007866
Florida: Ochlockonee River
71-008229
Florida: Okaloosa Cty.
71-007909
Florida: Pensacola Estuary
71-007798
Florida: St. Andrew Bay
71-008140
Florida: Tampa Bay
71-007794
71-008184
France: River Lot
71-008245
France: Verdon
71-013058
French Polynesia
71-007867
Georgia: Carroll Cty.: Dog River
71-008046
Georgia: Ochlockonee River
71-008229
Great Lakes/Larval Fish
71-008485
Guam
71-007967
Guatemala
71-008172
Gulf of Aqaba
71-008131
Gulf of Mexico
71-007752
71-007787
71-008045
Gulf of Mexico: Campeche Bank
71-008180
Gulf of Tonkin
71-007723
Halosauridae
71-008110
Hawaii: Coastal Ponds
71-007761
Hawaii: Oahu
71-010384
Idaho: Clearwater River
71-008040
Idaho: Palouse River
71-008041
Idaho: Silver Creek
71-007852
Illinois River, Lower
71-008212
India: Bhakra Reservoir
71-007734
Indian Ocean
71-007725
71-007862
71-007863
71-008087
71-008284
Indian Ocean: Mandapam Area
71-008188
Indiana: Sullivan Cty.
71-007958
Indiana: Tippecanoe Cty.
71-007811
Indiana: Washington Cty.: Blue River
71-008054
Iran
71-007790
71-008178
Ireland: Galway Bay
71-007850
Israel
71-007726
Japan: Hokkaido
71-007884
Japan: Honmura Bay
71-007898
Kansas: Doniphan Cty.: Wolf River
71-007789
Kazakhstan: Nura River Basin
71-007830

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Kentucky
71-007767
Kentucky: Calloway Cty.: Russells Chapel Spring
71-008145
Kentucky: Daniel Boone Natl. Forest
71-007757
Kentucky: Kentucky River
71-008280
Labridae
71-008594
71-008784
Lake Erie
71-008077
71-008272
71-012876
Lake Ontario
71-007807
Lake Superior
71-012874
Leptocephali
71-008789
Liparidae
71-008813
Louisiana
71-007683
71-008118
71-008119
71-008210
Louisiana: Atchafalaya River
71-007795
Louisiana: Caminada Bay
71-008079
Louisiana: Chenier Plain Coastal Area
71-007881
71-007882
71-007883
Louisiana: Lower Mississippi Basin
71-007795
Maryland
71-008002
Maryland: Conococheague Creek
71-008036
Massachusetts
71-007904
Massachusetts: Beverly-Salem Harbor
71-007954
Massachusetts: Pleasant Bay
71-007846
Mediterranean Sea
71-007726
71-008152
Mexico: Baja California: Pacific Ocean
71-007847
Mexico: Colima: Rio Armeria
71-007804
Mexico: Gulf of California
71-005930
Mexico: Rio Yaqui
71-007913
Michigan: Au Sable River
71-008407
Minnesota
71-007692
Minnesota: Minnesota River
71-008274
Mississippi River, Middle
71-008212
Mississippi: Horn Island
71-008078
Missouri River Basin, Upper
71-007959
Missouri, Northwestern
71-008074
Missouri: Big River
71-008067
Missouri: Black River
71-012949
Missouri: Cane Creek
71-008288
Montana, Southeastern
71-007837
Montana: Flathead Lake
71-001064
Montana: Tongue River
71-012941
Montana: Yellowstone River
71-008123
Morocco
71-007716
71-007762
Mugilidae
71-008838
Nebraska
71-008217
Nebraska: Adams Cty.: 32 Mile Creek
71-008257
Nebraska: Salt Creek
71-008027
Nebraska: Thirty-two Mile Creek
71-008258
Nevada: Clark Cty.: Moapa River
71-007806
Nevada: Death Valley
71-008066
New England: Continental Slope
71-007903
New Jersey, Coastal
71-008069
New Jersey: Delaware River Estuary
71-008260
New Jersey: Little Egg Inlet
71-008068
New Jersey: New York Bight
71-013256
New Jersey: Newark Bay
71-008179

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New Jersey: Sandy Hook Bay
71-008276
New Jersey: Stone Harbor
71-007972
New York
71-007759
New York: Arthur Kill
71-007763
New York: Atlantic Ocean
71-007917
New York: Long Island Sound
71-008291
New York: New York Bay
71-007857
New York: New York Bight
71-007700
71-008277
71-013256
New York: State Barge Canal
71-008154
New Zealand
71-008049
71-008581
New Zealand: Hen Island
71-007885
New Zealand: Karikari Peninsula
71-008279
New Zealand: Lake Chalice
71-008059
New Zealand: Lake Christabel
71-007956
New Zealand: Lake Ellesmere
71-008177
Nigeria: Benue River
71-008051
North Carolina
71-008015
71-008102
71-008103
71-008124
North Carolina: Croatan Natl. For.
71-008171
North Carolina: Newport River Estuary
71-007941
North Carolina: Onslow Bay
71-008014
North Dakota: Sheyenne River
71-008121
71-008122
North Sea
71-007922
Norway
71-008018
Norway: Lindaspollene
71-008011
Norway: Skjomen
71-008202
Ohio
71-007823
Ohio: Chagrin River
71-008272
Ohio: Green Creek
71-008228
Ohio: Portage River
71-007928
Ohio: Wayne Natl. For.
71-007708
Oklahoma: Kiamichi River
71-007832
Oklahoma: Mill Creek
71-007737
Oklahoma: Muddy Boggy River
71-008127
Ophidiiformes
71-008516
Pacific Ocean: California: Diablo Canyon
71-007942
Pacific Ocean: Oregon: Yaquina Bay
71-008151
Panama: Caribbean Sea
71-007812
Papua New Guinea/Exotic Species
71-012407
Papua New Guinea: Laloki River System
71-007728
Pennsylvania: Berks Cty.: Sacony Creek Basin
71-007707
Pennsylvania: Conewago Creek
71-008153
Pennsylvania: Conococheague Creek
71-008036
Pennsylvania: Swatara Creek Drainage
71-008135
Pennsylvania: Yellow Breeches Creek
71-008293
Pennsylvania: Youghiogheny River
71-007912
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71-008021
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71-008003
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71-008826
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71-008554
Rajoidea
71-008581
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71-007788
71-007878
71-008513
Rhabdosargus
71-008793
Rhodes
71-008692

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71-007978
Santa Monica Bay
71-007845
Saudi Arabia
71-007685
Sciaenidae
71-008828
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71-008025
Scotland: Outer Hebrides
71-007776
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71-007944
Sierra Leone
71-008098
Singapore
71-008200
South Africa
71-008284
South Africa: Indian Ocean
71-007945
South Africa: Natal: Kosi System
71-007743
South Africa: Sandvlei
71-007718
South Carolina: Folly Beach
71-007695
South Carolina: North Inlet
71-006589
South Carolina: South Atlantic Bight
71-008266
South China Sea
71-008189
South Dakota: Little Missouri River
71-007735
71-007736
South Dakota: Sioux Falls River Park
71-007756
South West Africa: Sandvis
71-007976
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71-008826
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71-008221
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71-008097
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71-008192
71-008194
71-008784
Tennessee: Clinch River
71-008032
Tennessee: Cumberland River
71-007915
Tennessee: Obion Cty.: Indian Creek
71-007946
Texas: Big Sandy Creek
71-007840
Texas: Chenier Plain Coastal Area
71-007881
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71-007883
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71-008723
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71-008513
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71-008772
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71-007851
71-008275
71-013469
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71-007859
USSR: Donets River
71-012993
USSR: Irtysh-Karaganda Canal
71-007677
USSR: Pacific Ocean
71-007944
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71-011724
Utah: San Rafael River
71-008044
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71-008000
Virginia, Southeastern
71-007953
Virginia: Clinch River
71-008032
Virginia: East River
71-008218
Virginia: Fairfax Cty.
71-007974
Virginia: James River
71-008017
Virginia: Lynnhaven Bay
71-008183
Virginia: New River
71-008134
Virginia: Piankatank River
71-008060
Washington
71-008285
Washington: Crab Creek
71-008039
Washington: Palouse River
71-008041
Washington: Puget Sound
71-007698
71-008084
West Germany
71-008757
West Virginia
71-007818

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West Virginia: East River
71-008218
West Virginia: Gauley River
71-007925
West Virginia: Greenbrier River
71-007924
Yugoslavia: Skadar Lake
71-007981
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71-009700
Bothriocephalus cuspidatus
71-009715
Bothriocephalus gowkongensis
71-009811
71-009917
Botulism
71-009208
Bouixella
71-009622
Branchiomyces
71-010517
Branchiura
71-009592
Broken Back Syndrome
71-009731
Bucephalidae
71-009753
Bucephalopsis karvei
71-009658
Bucephalopsis labiatus
71-009850
Caligidae
71-009696
Camallanus ancylodirus
71-009494
Camallanus lacustris
71-009926
Camallanus oxycephalus
71-009938
Capillaria catostomi
71-009502
Cardiodectes medusaeus
71-009813
Carp Erythrodermatitis
71-009061
Caryophyllaeidae
71-009656
71-009987
Cataracts
71-009874
Cauliflower Disease
71-009602
CCVD
71-008956
71-009399
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71-009436
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71-009446
71-009447
Cell Culture
71-009399
71-009426
Ceratomyxa
71-009343
Ceratomyxa anoplopoma
71-009338
Ceratomyxa shasta
71-009305
71-009382
71-009383
Ceroidosis
71-009930
Cestodes
71-009479
71-009485
71-009489
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71-009555

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Parasites/Diseases
Cestodes
71-009556
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71-010001
71-010630
71-012341
Chilodonella hexasticha
71-009301
Chloramine-T
71-009089
Chloramphenicol
71-009196
Chloromyxum trijugum
71-009334
Chloromyxum truttae
71-009290
Chondracanthidae
71-009699
Chondracanthus angustatus
71-009902
Chondrococcus columnaris
71-008956
71-009199
Ciguatera
71-004479
71-009946
71-010006
71-011549
71-011550
Cirkennedya porlockensis
71-009649
Clavellodes macrotrachelus
71-009553
Cleidodiscus ektyphus
71-009793
Cleidodiscus pricei
71-009580
Cleidodiscus robustus
71-009506
Cleidodiscus stentor
71-009667
Clinostomum
71-009611
Clinostomum marginatum
71-009680
Clostridium botulinum
71-009208
71-010850
Cod-Worm
71-009515
Codonophilus imbricatus
71-009936
Coelenterates
71-009882

...CONTINUED...
Parasites/Diseases
Coelenterates
71-009942
Colobomatus labracis
71-009881
Columnaris Disease
71-009199
Congericola kabatai
71-009693
Conispora renalis
71-009362
Contracaecum
71-009783
71-009860
71-009971
71-009976
Corallotaenia minutia
71-009947
71-009948
Corynebacterium
71-008942
71-009143
71-009217
71-010932
Corynebacterium salmoninus
71-009069
71-009130
Costia necatrix
71-009282
Costiasis
71-009282
Crassiphiala bulboglossa
71-009968
Cryptobia
71-009355
Cryptobia catostomi
71-009253
71-009254
Cryptobia salmositica
71-009324
71-009380
Cryptocaryon irritans
71-009259
Cryptocaryoniasis
71-009259
Cryptocotyle lingua
71-009966
Cryptogonimidae
71-009654
Cyclocotyla bellones
71-009766
Cymothoa excisa
71-009978
Cymothoidae
71-009900
Cystidicola cristivomeri
71-005574
71-009757
Cystidicola farionis
71-009757
71-009963
Cystobranchus meyeri
71-009679
Cytophaga psychrophila
71-009189
Dactylogyrus
71-009579
71-009668
71-009796
71-009841
Dactylogyrus atripinnei
71-009954
Dactylogyrus unguiformis
71-009749
Davisia
71-009346
Davisia reginae
71-009323
Degeneria halosauri
71-009557
Deretrema
71-009544
Dermal Sarcoma
71-009471
71-009474
Dicauda atherinoida
71-009296
Dichelyne bullocki
71-009754
Diclidophora
71-009771
Diclidophora embiotocae
71-009669
Diclidophora esmarkii
71-009764
Dina lineata
71-009483
Dinemoleus indeprensus
71-009591
Diphyllobothrium
71-009689
71-010001
Diphyllobothrium dendriticum
71-009485
71-009688
Diphyllobothrium ditremum
71-009688
Diplectanum aequans
71-009847
Diploproctodaeum plicitum
71-009984
Diplostomulum scheuringi
71-009686
Diplostomum
71-009595
71-009884
Diplostomum adamsi
71-009761
71-009762

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Parasites/Diseases
Diplostomum gasterostei
71-009734
Diplostomum spathaceum
71-009548
71-009594
71-009681
71-009685
71-009858
Diplozoon homoion gracile
71-009770
Diplozoon nipponicum
71-009727
Disease Defense Mechanisms
71-008907
Disease Importation
71-008929
71-008940
71-008947
71-009202
Disease-Free Culture
71-008893
71-008935
Dropsy
71-009646
71-009648
Duplicibothrium minutum
71-009986
Echeneibothrium
71-009560
71-009573
Echinobothrium euzeti
71-009555
Echinocephalus sinensis
71-009744
Echinorhynchus
71-009806
Echinorhynchus canyonensis
71-009705
Echinorhynchus salmonis
71-009478
71-009480
Edema
71-009628
Edwardsiella
71-009113
Edwardsiella tarda
71-009119
71-009140
Egtved Virus
71-009411
Eimeria anguillae
71-009295
Eimeria funduli
71-009277
71-009368
Enenterum
71-009529
Enteric Redmouth Disease
71-009064
71-009067
71-009070
71-009071
71-009107
71-009215
Enteric Septicemia of Catfish
71-009113
Enterobacteriaceae
71-009099
Enteroviruses
71-009460
Epidermal Lesions
71-009536
71-009803
71-009891
Epidermal Papillomas
71-009602
Epistylis
71-008990
71-009114
71-009115
71-009258
71-009304
71-009322
Epistylis niagarae
71-009263
Epitheliocystis
71-009862
Ergasilus
71-009550
71-009702
71-009866
Ergasilus centrarchidarum
71-009581
71-009667
Ergasilus labracis
71-009703
71-009859
Ergasilus lizae
71-009665
Ergasilus manicatus
71-009521
Ergenstrema mugilis
71-009755
Erythrodermatitis
71-009537
Escherichia coli
71-009178
Eubacterium
71-009147
Eubacterium tarantellus
71-009212
Eubothrium
71-009736
Eubothrium crassum
71-009625
71-009735
Eubothrium parvum
71-009733

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Parasites/Diseases
Eubothrium salvelini
71-009525
71-009735
71-010630
Eustrongylides
71-009738
Exophiala
71-009223
Exophiala salmonis
71-009235
Fin Erosion
71-009800
71-009980
71-010298
Fin Rot
71-009098
71-009157
71-009161
71-009162
71-009172
Flexibacter
71-009117
71-009177
Flexibacter columnaris
71-008936
71-009057
71-009060
71-009188
71-009189
71-009193
71-009194
Fungal Diseases
71-008944
71-009222
71-009223
71-009224
71-009225
71-009226
71-009227
71-009228
71-009229
71-009230
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71-011543
Furanace
71-009076
71-009158
71-011153
Furunculosis
71-000202
71-009080
71-009086
71-009153
71-009155
71-009168
71-009169
71-009185
71-009197
71-009198
Fusobacteria
71-009123
Galactosomum phalacrocoracis
71-009865
Gallbladder Lesions
71-009673
Gas Bubble Disease
71-000627
71-006623
71-009522
71-009616
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71-009720
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71-009979
71-010625
Gastrocotyle trachuri
71-009919
Genarchopis goppo
71-009778
General
71-000183
71-000270
71-000757
71-002302
71-003426
71-004194
71-008056
71-008441
71-008514
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71-008904

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Parasites/Diseases
General
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71-008906
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71-008910
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71-009476
71-009508
71-009606
71-009878
71-009889
71-011543
71-012324
71-012955
General/Alaska
71-008983
General/Canada
71-008982
General/Connecticut
71-009007
General/Diagnostic Techniques
71-009010
71-009038
General/France
71-009002
General/Georgia
71-008966
General/Greece
71-008937
General/India
71-008996
General/Malaysia
71-008979
General/Manitoba
71-009037
General/Venezuela
71-008908

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Parasites/Diseases
General/Yugoslavia
71-007981
Gill Diseases
71-009089
Gill Hyperplasia
71-009717
Gill Parasites
71-008904
71-008949
71-008950
71-008951
71-008980
71-009025
71-009492
71-009506
71-009507
71-009666
71-009667
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71-009730
71-009764
71-009828
71-009843
71-009919
Gilquinia squali
71-009773
Glomerular Mesangial Fibrosis
71-009694
Glugea anomala
71-009280
Glugea atherinae
71-009249
Glugea hertwigi
71-009017
71-009353
Glugea stephani
71-009330
71-009358
Glyphobothrium zwerneri
71-009985
Goezia
71-009601
Goiters
71-009588
71-009810
Golden Shiner Virus
71-009448
71-009457
Gracilisentis gracilisentis
71-009716
Green Liver
71-009906
Grillotia dollfusi
71-009571
Grillotia erinaceus
71-009768
71-012341
Gyrodactylus
71-009782
71-009796
71-009842
71-009894
Gyrodactylus elegans
71-009653
Gyrodactylus plotosi
71-009794
Gyrodactylus salaris
71-009718
Gyrodactylus stephanus
71-009497
Gyrometra kunduchi
71-009742
Haematractidium scombri
71-009326
71-009836
Haemogregarina
71-009307
Haemogregarina aeglefini
71-009283
Haemogregarina bigemina
71-009271
Haemogregarina sachai
71-009312
71-009313
71-009315
Haemogregarina simondi
71-009311
71-009314
Haemohormidium cotti
71-009598
71-009599
Hagerman Redmouth Disease
71-009072
Haliotrema kurodai
71-009845
Haplocleidus dispar
71-009507
Harveytrema bisulcatum
71-009750
Hatschekia plectropomi
71-009695
Hedruris spinigera
71-009655
Helminths
71-008957
71-009482
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71-009719

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Parasites/Diseases
Helminths
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71-009797
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Hematozoa
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71-009283
71-009306
71-009312
71-009313
71-009321
71-009374
71-009380
Hemiuridae
71-009753
Hemorrhagic septicemia
71-009118
Henneguya
71-009243
71-009281
71-009331
71-009333
71-009367
Henneguya adiposa
71-009266
Henneguya episclera
71-009332
Henneguya exilis
71-009264
71-009265
71-009267
71-009268
71-009363
Henneguya ophiocephali
71-009291
Henneguya psorospermica
71-009241
Henneguya sebasta
71-009294
71-009340
Hepato-Renal Syndrome
71-009240
Hepatomas
71-009800
71-009872
71-009931
71-009973
Herpesvirus scophthalmi
71-009402
71-009453
Hexamita salmonis
71-009285
Holobomolochus embiotocae
71-009665
Horricauda rhinobatidis
71-009730
Hudsonia agassizi
71-009559
Hyperostosis
71-009827
Hyperplasia
71-011029
Hypervitaminosis A
71-000763
Ichthyophonus
71-009222
Ichthyophthirius multifiliis
71-009248
71-009284
71-009318
71-009325
Ichtyobodo necator
71-009282
71-009360
ICPN
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IHN
71-008936
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71-009438
71-009444
71-009467
71-009468
Immune Hypersensitivity
71-009683
Immune Response
71-003110
71-003667
71-004131
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71-009047
71-009053
71-009102

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Parasites/Diseases
Immune Response
71-009126
71-009156
71-009171
71-009365
71-009366
71-009447
71-011430
71-011432
Immunization
71-00888
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71-009129
71-009137
71-009138
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71-009165
71-009193
71-009211
Injuries
71-009901
Interniloculus chilensis
71-009943
IPN
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71-009470
Irona melanosticta
71-009936
Isoglaridacris wisconsinensis
71-009989
Isoparorchis hypselobagri
71-009780
71-010007
Janiszewskella
71-009775
Keloids
71-009928
Kudoa clupeidae
71-009294
Kudoa pericardialis
71-009352
Lamellodiscus
71-009843
Lathyrism
71-009909
Lecithophyllum irelandeum
71-009852
Leeches
71-009483
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71-009974
71-009982
Lepeophtheirus
71-009610
Lepeophtheirus pectoralis
71-009523
71-009524
Lepeophtheirus salmonis
71-009526
Lepocreadium manteri
71-009849
Leptorhynchoides aphredoderi
71-009538
Leptorhynchoides thecatus
71-009620
71-009690
Leptotheca
71-009342
Lernaea cyprinacea
71-009541
71-009542
71-009604
71-009618
71-009619

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Parasites/Diseases
Lernaea cyprinacea
71-009741
71-009760
71-009968
71-009981
Lernaeenicus
71-009885
Lernaeenicus hemirhamphi
71-009829
Lernaeenicus radiatus
71-009970
Lernaeenicus sprattae
71-009915
Lernaeocera branchialis
71-009732
71-009951
71-009965
Lernaeolophus
71-009499
Ligula intestinalis
71-009781
71-009944
71-009945
Lipophoromatosis
71-009540
Lironeca ovalis
71-009876
Lissorchis hypentelii
71-009990
Lissorchis kritskyi
71-009498
Lymphocystis
71-008984
71-009387
71-009391
71-009393
71-009405
71-009430
71-009437
71-009440
71-009464
71-009469
71-009471
Lymphosarcomas
71-009890
Macroderoides trilobatus
71-009950
Macrovalvitrematoides micropogoni
71-009722
Malmiana
71-009545
Malmiana philotherma
71-009974
Margaritifera margaritifera
71-009643
71-009805
Meinertia
71-009898
Meinertia oestroides
71-009899
Meningitis
71-009147
71-009181
Metamicrocotyla macracantha
71-009809
Microparynx parasitica
71-009495
Microsporida
71-009273
71-009353
71-009565
Monostephanostomum manteri
71-009751
Mugilicola
71-009721
Muscle Necrosis
71-009704
Mycobacterium
71-009040
71-009051
71-009096
71-009097
71-009205
Mycobacterium fortuitum
71-009058
Mycoplasmas
71-009790
Myofibrogranuloma
71-009636
Myxidium
71-009348
71-009354
Myxidium incurvatum
71-009240
Myxidium truttae
71-009290
Myxidium zealandicum
71-009317
Myxobilatus
71-009242
71-009251
Myxobolus
71-009275
71-009361
Myxobolus dentium
71-009288
Myxobolus exiguus
71-009365
71-009366
Myxobolus insidiosus
71-009381
Myxobolus latipinnacola
71-009375
Myxoproteus
71-009341
Myxosoma cerebralis
71-009270

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Parasites/Diseases
Myxosoma cerebralis
71-009289
71-009292
71-009293
71-009297
71-009298
71-009299
71-009319
71-009328
71-009356
71-009357
71-009373
71-009376
71-009377
71-009378
Myxosoma funduli
71-009269
71-009316
Myxosoma microspora
71-009828
Myxosoma notropis
71-009274
Myxosporida
71-009261
71-009265
71-009274
71-009275
71-009280
71-009281
71-009288
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Neascus cuticola
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Neascus ptychocheilus
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Neascus pyriformis
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Neascus rhinichthysi
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Nematobothrium spinneri
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Nematodes
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Parasites/Diseases
Nematodes
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Neobenedenia girellae
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Neocamallanus bareilliensis
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Neoechinorhynchus cylindratus
71-009838
Neoechinorhynchus rutili
71-009962
Neoechinorhynchus saginatus
71-009820
Neohystero indicus
71-009473
Neohystero lecitha
71-009473
Neometadidymozoon helicis
71-009759
Nephrocalcinosis
71-008942
71-009651
71-009674
71-009927
Nerocila californica
71-009961
Nezpercella lewisi
71-009910
Nitrofurazone
71-009351
Nutritional Diseases
71-000888
71-009384
71-009874
71-009893
71-009930
Oceanobdella sexoculata
71-009726
One-Eye Disease
71-009711
Opecoelidae
71-009753
Opisthorchis pedicellata
71-009663
Ornithodiplostomum ptychocheilus
71-009684
71-009932
Oxytetracycline
71-009031
Pansteatitis
71-009893
Parabothriocephalus sagitticeps
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Paraneocreadium australiense
71-009752
Parasitic Copepods
71-007224
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Parasitic Copepods
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Parasitic Isopods
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Parasitic Molluscs
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Parasiticides
71-010821
Paravitellotrema overstreeti
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Pasteurella
71-009066
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Pasteurella piscicida
71-009163
Pasteurellosis
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Penarchigetes fessus
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Peniculus asinus
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Perioderma
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Perioderma tasselum
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Philobythos atlanticus
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Philometra
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Philometra cylindracea
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Philometra mariae
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Philometroides
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Philometroides huronensis
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Phocanema decipiens
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Phocascaris
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Phoma herbarum
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Phyllobothrium kingae
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Phyllodistomum scrippsi
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Phyllodistomum undulans
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Piromidic Acid
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Piscicolaria reducta
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Piscine Erythrocytic Necrosis
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Pituitary Cysts
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Plagioporus shawi
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Pleistophora ovariae
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Pleistophora typicalis
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Plethorchis acanthus
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Podocotyle atomon
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Poecilancistrium caryophyllum
71-009853
Polyonchobothrium clarias
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Polyonchobothrium scleropagis
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Polypodium
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Polypodium hydriforme
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Pomphorhynchus bulbocolli
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Pomphorhynchus laevis
71-009737

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Parasites/Diseases
Pomphorhynchus laevis
71-009739
Potassium Permanganate
71-009174
Proleptus mackenziei
71-009996
Proliferative Kidney Disease
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Protancyrocephaloides liopsettae
71-009543
Proteocephalus
71-009520
71-009822
Proteocephalus buplanensis
71-009479
71-009792
Proteus rettgeri
71-009059
Protozoan Diseases
71-008942
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Protozoan Diseases
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Pseudechetus fimbriatus
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Pseudodactylogyrus
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Pseudodactylogyrus microrchis
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Pseudomonas
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Pseudomonas anguilliseptica
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Pseudomonas fluorescens
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Pseudomonas reptilivora
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Pseudonicothoe branchialis
71-009492
Pseudophyllidae
71-009556
Ptarocleidus acer
71-009507
Raphidascaris acus
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Red-Sore Disease
71-009115
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Red-Spot Disease
71-009041
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Renibacterium salmoninarum
71-009186
Renicola
71-009772
Rhabdochona catostomi
71-009728
Rhabdochona parastromatei
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Rhabdospora thelohani
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Rhabdovirus Disease
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Rhabdochona kisutchi
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Rhinebothrium
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Rhinoptericola megacantha
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Rhipidocotyle linteni
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Parasites/Diseases
Rhipidocotyle transversale
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Rogersus rogersi
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Rowardleus
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Saddleback Disease
71-009073
Salmincola
71-009702
Salmincola californiensis
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Salmincola edwardsii
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Salmon Lice
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Salmonella
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Saprolegnia
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Saprolegnia diclina
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Sarcocystis
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SBS
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Schistocephalus solidus
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Sclerocollum rubrimaris
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Serpentisaccus magnificae
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Sphaerospora angulata
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Spinitectus gorduni
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Spinitectus gracilis
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Spinitectus micracanthus
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Spirocamallanus
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Spiruroidea
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Spring Viremia
71-009385
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Spriocamallanus cricotus
71-009638
Spruce Budworm Nuclear Polyhedrosis Virus
71-009456
Streptococcus
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Strigeoids
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Systemic Granulomata
71-009443
Telogaster opisthorchis
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Tergestia karachiense
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Terranova decipiens
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Tetracycline Hydrochloride
71-011349
Tetrahymena
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Tetraonchus
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Tetraonchus rauschi
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Textrema hopkinsi
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Thyroid Hyperplasia
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Trachelobdella oregonensis
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Transversotrema patialense
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Trematodes
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Trematodes
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Trichlorfon
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Trichodina oviducti
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Trichodinid Ciliates
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Triganodistomum attenuatum
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Troglocephalus rhinobatidis
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Truttaedacnites truttae
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Truttaedacnitis stelmioides
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Trypanoplasma beckeri
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Trypanoplasma borelli
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Trypanoplasma salmositica
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Trypanorhyncha
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Trypanosoma catostomi
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Trypanosoma choudhuryi
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Trypanosoma
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Turbellarians
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Turgescence longifucces
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Tylodelphys clavata
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Ulcerative Dermal Necrosis
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Ulcers
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Ultraviolet Light
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Unicoelium prochilodorum
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Urceolariidae
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Urocleidus adspectus
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Urocleidus angularis
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Urocleidus ferus
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Urocleidus nactus
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Uronema marinum
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Uvulifer
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Vertebral Dysplasia
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Vibrio
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Vibrio anguillarum
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Vibrio parahaemolyticus
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Vibriosis
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Parasites/Diseases
Vibriosis
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Viral Diseases
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Viral Erythrocytic Necrosis
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Viral Hemorrhagic Septicemia
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Wenyonia virilis
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Whirling Disease
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Whirling Disease
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Yersinia ruckeri
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Zschokkella
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Zschokkella embiotocidis
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Physiology
Acidosis
71-003230
Acoustico-Lateralis System
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Actomyosins
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Adenosine
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Adrenaline
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71-004256
Aestivation
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Air Breathing
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Hexachlorane
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Hexachlorobenzene
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Hexachlorocyclopentadiene
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Hexachloronobornadiene
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Hexadrin
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Hydraulic fluids
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Hydrazine
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Hydrocarbons
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Hydrogen Cyanide
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Hydrogen Sulfide
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Ichthyootoxin
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Imidan
71-010961
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71-011467
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Iron
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Kapone
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Kerosene
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Lathyrogens
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Lead
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Lead Chloride
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Lead Nitrate
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Lindane
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Lindane
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Logging Residue
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Malachite Green
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Malaoxon
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Malathion
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Manganese
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Masoten
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MCPA
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Mercaptobenzothiazole
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Mercuric Chloride
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Mercury
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Methallibure
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Methanol
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Methoprene
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Methoxychlor
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Methylene Chloride
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Mexacarbate
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Mine Effluents
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Mirex
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Molinate
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Molluscicides
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Molybdenum
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Monochloramines
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Monocrotophos
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Morpholine
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Mosquito Control
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MS-222
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Neuroamines
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Nickel
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Nitrosamines
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Phosphate
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Phosphate Esters
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Phosvel
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Picloram
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Polychlorinated Terphenyls
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Polychloropinene
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Polyvinyl Chloride
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Potassium
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Potassium Permanganate
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Pounce
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Power Plant Effluents
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Propamil
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Proposur
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AQUATIC PLANTS AND THEIR CONTROL

80-000001 Hitchin, G. G. WEED HARVESTING AS A VIABLE LAKE MANAGEMENT TECHNIQUE. Trent Univ. Biol. Dep. Ecol. Bull. 2 (1): 16-20. 1976. SFA 25(1)
[Limnol. Toxicity Sect., Minist. Environ., Rexdale, ON, Canada]

80-000002 Ogle, J. TRANSLUCENT TANK FOR ALGAL CULTURE. Prog. Fish-Cult. 47 (4): 191. Oct. 1979. SFA 25(1)
[Gulf Coast Res. Lab., East Beach Dr., Ocean Springs, MS 39564]

80-000003 Skea, J. C.; Simonin, H. A. EVALUATION OF CUTRINE FOR USE IN FISH CULTURE. Prog. Fish-Cult. 47 (4): 171-174. Oct. 1979. SFA 25(1)
[N.Y. State Dep. Environ. Conserv., 8314 Fish Hatchery Rd, Rome 13440]

GENERAL FISH CULTURE

80-000004 Lovell, R. T. FISH CULTURE IN THE UNITED STATES. Science 206 (4425): 1368-1372. 21 Dec. 1979. SFA 25(1)
[Dep. Fish. Allied Aquacult., Auburn, AL 36830] The culture of channel catfish, trout, and crayfish is a well-established, profitable enterprise, but aquaculture provides only a fraction of the protein consumed by Americans, who prefer red meat. This situation could change, since pond-raised fish require less energy for protein synthesis than land animals, the supply of ocean food fish no longer appears inexhaustible, and fish culture can utilize resources unsuitable for other agriculture.

80-000005 Tal, S. THE CONCEPT OF AQUACULTURE. Bamidgeh 31 (2): 23-25. June 1979. SFA 25(1)
[Minist. Agric., Fish. Dep., Hakiriah, Tel-Aviv, Israel]

TROUT AND SALMON CULTURE

80-000006 Blanc, J. M.; Chevassus, B. INTERSPECIFIC HYBRIDIZATION OF SALMONID FISH. I. HATCHING AND SURVIVAL UP TO THE 15TH DAY AFTER HATCHING IN F1 GENERATION HYBRIDS. Aquaculture 18 (1): 21-34. Sept. 1979. SFA 25(1)
[Lab. Ecol. Poissons Amenage. Peches, I.N.R.A., St.-Pee-sur-Nivelle, 64 310 Ascain, France] Artificial hybridizations were carried out with 17 combinations using six species of Salmonidae, namely chinook

80-000006 CONTINUED
and coho salmon, rainbow and brown trout, Atlantic salmon and brook trout. Success at the eyed stage, survival rates up to the 15th day after hatching, length of the incubation period and dispersion of hatching times were examined with reference to monospecific control lots. Success and survival rates of hybrids were found to be inferior or at the best similar to those of parental species. Significant maternal effects were observed within most types of crosses. Highly variable interaction factors were found to influence the length of incubation of hybrids, which could exceed that of either parental species. The dispersion of hatching times was greater in hybrids than in pure species and tended to be negatively correlated to survival. A few types of hybrids showed promising results at the end of the experiment and their potential interest for aquaculture is discussed.

80-000007 Harris, L. E. MANIPULATING PHOTOPERIODS IN HATCHERY-REARED RAINBOW BROODFISH TO CONTROL SPAWNING ACTIVITIES. Colo. Div. Wildl. Fish. Inf. Leafl. No. 32. 2p. Oct. 1979. SFA 25(1)
[Colo. Div. Wildl., 317 W. Prospect, Fort Collins 80522]

80-000008 Higgs, D. A.; Eagerlund, U. H. M.; McBride, J. R.; Eales, J. G. INFLUENCE OF ORALLY ADMINISTERED /L/-THYROXINE OR 3,5,3'-TRIIODO-/L/-THYRONINE ON GROWTH, FOOD CONSUMPTION, AND FOOD CONVERSION OF UNDERYEARLING COHO SALMON (/ONCORHYNCHUS KISUTCH/). Can. J. Zool. 57 (10): 1974-1979. Oct. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Between August and November, groups of underyearling coho salmon, held at 10°C and on a natural photoperiod, were fed twice daily to satiation with Oregon moist pellets supplemented with 0, 20, 100, or 500 ppm of L-thyroxine (T(4)) or 3,5,3'-triiodo-L-thyronine (T(3)). The T(3) significantly increased weight (20 and 100 ppm) and length (all doses), depressed condition factor (100 and 500 ppm), stimulated food consumption (20 ppm), improved food conversion (all doses), decreased thyroid follicle epithelial height (500 ppm), and influenced pituitary basophil and somatotrop number, size, and granulation. The T(4) influenced neither growth nor food conversion, but did increase food consumption (20 ppm) and condition factor (500 ppm), and decreased thyroid follicle epithelial height (500 ppm). No breakdown of either added T(4) or T(3) was observed during prolonged food storage. It is concluded that T(3), unlike T(4), can be administered in the diet of coho held at 10°C to enhance growth and improve food conversion.

80-000009 Johnstone, R.; Simpson, T. H.; Youngson, A. F.; Whitehead, C. SEX REVERSAL IN SALMONID CULTURE. PART II. THE PROGENY OF SEX-REVERSED RAINBOW TROUT. Aquaculture 16 (1): 13-19. Sept. 1979. SFA 25(1)
[Mar. Lab., Aberdeen, Scotland] A sample of the all-male population of rainbow trout resulting from the dietary administration of 17 alpha-methyltestosterone at a concentration of 3 mg/kg of food to juvenile fish during the 90-day period following "swim up" was grown to sexual maturity. It was observed that in many specimens there were deformations of the reproductive system which prevented the normal expression of milt although spermatozoa from the testes were viable. Sperm specimens removed surgically or normally expressed from mature fish were separately used to fertilise the mixed ova from untreated females. All the progeny of one such pairing were females. This indicates that in rainbow trout it is the female sex which is homogametic. Samples of the all-female population which resulted from the dietary administration of 17 beta-oestradiol at a concentration of 20 mg/kg of food to rainbow trout fry during the 56-day period

80-000009 CONTINUED
following "swim up" were also grown to maturity. The ova stripped from these fish were separately fertilised with mixed milt expressed from normal males. The progeny of two of five such pairings had a combined male to female ratio of 2.2, indicating that in rainbow trout the male is heterogametic for sex. The results were insufficient to permit any reliable estimate of the degree of impairment of the viability of the YY constitution. A method of producing single sex populations by the mating of sex reversed with normal fish is discussed.

80-000010 Johnstone, R.; Simpson, T. H.; Walker, A. F. SEX REVERSAL IN SALMONID CULTURE. PART III. THE PRODUCTION AND PERFORMANCE OF ALL-FEMALE POPULATIONS OF BROOK TROUT. Aquaculture 18 (3): 241-252. Nov. 1979. SFA 25(1)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen, Scotland]
Oral administration of 17 beta-oestradiol at 20 mg/kg diet for a period from 0 to 60 days following "swim-up" resulted in the sex reversal of male brook trout and the production of essentially all-female populations. The gonads of these animals were indistinguishable from the ovaries of untreated fish. Oral administration of this hormone at the same concentration but for the period from 0 to 40 days resulted in a population which comprised 67 percent females, 21 percent males and 12 percent bisexual animals. Within the control group, the growth rate of males was significantly greater than that of females. Growth in the all-female stocks produced by dietary oestradiol administration (0-60 days) was significantly lower than that of the untreated population taken as a whole but was identical to that of the control females. The growth of brook trout during the first year was closely comparable to that of rainbow trout reared under identical conditons. During the second year, the growth of the rainbow trout exceeded that of the brook trout. At 19 months of age, all the animals in the control and oestradiol treated brook trout populations were fully mature; maturity in the rainbow trout was substantially confined to males.

80-000011 Pitman, R. W. EFFECTS OF FEMALE AGE AND EGG SIZE ON GROWTH AND MORTALITY IN RAINBOW TROUT. Prog. Fish-Cult. 47 (4): 202-204. Oct. 1979. SFA 25(1)
[Pittsford Natl. Fish Hatchery, Pittsford, VT 05736]

80-000012 Smoker, W. W.; Kerns, C. L. ARTIFICIAL SALMON SPAWNING. A MANUAL. Univ. Alaska Sea Grant Mar. Advis. Bull. No. 7. 21p. 1979. SFA 25(1)
[Div. Fish., Univ. Alaska, P.O. Box 1447, Juneau 99802]

OTHER ANADROMOUS SPECIES CULTURE

80-000013 Wawronowicz, L. J.; Lewis, W. M. EVALUATION OF THE STRIPED BASS AS A POND-REARED FOOD FISH. Prog. Fish-Cult. 41 (3): 138-140. July 1979. SFA 25(1)
[Fish. Res. Lab., South. Ill. Univ., Carbondale 62901]

WARMWATER CULTURE

80-000014 Babiker, M. M.; Ibrahim, H. STUDIES ON THE BIOLOGY OF REPRODUCTION IN THE CICHLID /TILAPIA NILOTICA/ (L.): EFFECTS OF STEROID AND TROPHIC HORMONES ON OVULATION AND OVARIAN HYDRATION. J. Fish Biol. 15 (1): 21-30. July 1979. SFA 25(1)
[Dep. Zool., Univ. Khartoum, Sudan] The effects of intraperitoneal injections of cortical and ovarian steroids and trophic (mammalian) hormones on ovulation, ovarian hydration and the distribution of sodium ions in muscles and ovary was studied in /Tilapia nilotica/. Corisol, corticosterone and oestradiol 17 Beta (50-250 mg kg^{-1} B.W.) induced ovulation in a dose-dependent manner and increased the degree of hydration of muscle and ovarian tissues. The sodium ion content of muscles was reduced and that of ovaries increased following treatment with these hormones. Oestrone, Oestriol and progesterone (60-245 mg kg^{-1} B.W.) failed to induce ovulation but produced the same types of effects on the water and sodium ion content of muscles and ovaries as the other steroids. Human chorionic Gonadotrophin, HCG, (1200-12,000 I.U. kg^{-1} B.W.) also induced ovulation and increased the degree of hydration of muscles and ovaries and increased the sodium ion concentration in ovarian and reduced that of muscle tissues. Pregnant Mare Gonadotrophin, PMG, in doses similar to those of HCG, did not induce ovulation in any of the treated fish and did not significantly alter the water or sodium ion content of muscles and ovaries.

80-000015 Baur, R. J.; Buck, D. H.; Rose, C. R. PRODUCTION OF AGE-0 LARGEMOUTH BASS, SMALLMOUTH BASS, AND BLUEGILLS IN PONDS STOCKED WITH GRASS CARP. Trans. Am. Fish. Soc. 108 (5): 496-498. Sept. 1979. SFA 25(1)
Ill. Nat. Hist. Surv. ,Kinmundy 62854]

80-000016 Bulak, J. S.; Walker, P. T. SPAWNING AND CULTURE POTENTIAL OF BLUEBACK HERRING IN PONDS. Prog. Fish-Cult. 47 (4): 183-184. Oct. 1979. SFA 25(1)
[S.C. Dep. Wildl. Mar. Resour., P.O. Drawer 170, Bonneau 29431]

80-000017 Ghorai, A. K.; Mondal, K. M.; Sengupta, A.; Chakraborty, D.; Ranadhir, M.; Das, P.; Jhingran, V. G. ATTAINMENTS OF COMPOSITE FISH CULTURE DEMONSTRATION CENTRES IN WEST BENGAL DURING 1976-77. Cent. Inland Fish. Res. Inst. Barrackpore Bull. No. 30. 18p. Feb. 1979. SFA 25(1)
[Cent. Inland Fish. Res. Inst., Barrackpore, West Bengal, India]

80-000018 Hogendoorn, H. CONTROLLED PROPAGATION OF THE AFRICAN CATFISH, /CLARIAS LAZERA/ (C. & V.). I. REPRODUCTIVE BIOLOGY AND FIELD EXPERIMENTS. Aquaculture 17 (4): 323-333. Aug. 1979. SFA 25(1)
[Dep. Fish Cult. Inland Fish., Agric. Univ., P.O. Box 338, Wageningen, The Netherlands] Field experiments on controlled propagation of /Clarias lazera/ (C. & V.) were carried out in Cameroon in 1975-1976. Reproduction was induced in small ponds using desoxycorticosterone acetate. In artificial reproduction experiments, ovulation was induced with acetone-dried carp pituitary and the sexual products were obtained by stripping the females and dissecting the males. Artificial fertilization, incubation and hatching of the eggs were successfully carried out. Different methods of producing fingerlings in ponds were compared but none was considered satisfactory. Rearing the fry in troughs was not achieved, but it is

80-000018 CONTINUED
felt that this offers the best prospects for reliable production of fingerlings. Suggestions for further improvement of the techniques are given.

80-000019 Horvath, L. ELIMINATION OF THE GLUTINOSITY OF WELS (/SILURUS GLANIS/ L.) EGGS BY INDUSTRIAL ENZYME. Riv. It. Piscic. Ittiop. 14 (2): 39-44. Apr.-May-June 1979. In English and Italian. SFA 25(1)

80-000020 Jhingran, V. G.; Sehgal, K. L.; Kumar, K.; Ghosh, B. B. REARING ADVANCED FRY OF MAJOR INDIAN CARP SPECIES IN RECIRCULATORY-FILTERING PONDS AT BARRACKPORE, WEST BENGAL. Aquaculture 18 (1): 45-49. Sept. 1979. SFA 25(1)
[Cent. Inland Fish. Res. Inst., Barrackpore 743 101, West Bengal, India] This paper describes an experiment using a recirculatory-filtering system operating in two rectangular cemented ponds (160 and 190 m², 1.5 m deep) to rear fry (25 mm-50 mm) of the major Indian carp species /Labeo rohita/ (Hamilton) and /Catla catla/ (Hamilton) to fingerlings (100 mm-125 mm). These oeprations were concluded in both the species in 32 days at stocking densities of 0.46 million/ha and 0.55 million/ha, and showed survival rates of 96.6 percent and 84.4 percent respectively. In the presently followed practices of modern fish culturists, corresponding operations in earth ponds usually take 90 days and have a stocking density of 0.2 million/ha with survival rates more or less similar to those obtained in the recirculatory-filtering system. If followed by industry, the technique described will enable production of major Indian carp fingerlings with great saving in time, the use of water and the space occupied by the production system. These advantages greatly enhance the economic viability of rearing carp fingerling in India.

80-000021 Kuo, C.-M.; Nash, C. E.; Watanabe, W. O. INDUCED BREEDING EXPERIMENTS WITH MILKFISH, /CHANOS CHANOS/ FORSKAL, IN HAWAII. Aquaculture 18 (2): 95-105. Oct. 1979. SFA 25(1)
[Oceanic Inst., Waimanalo, HI 96795] The hormones SG-G100, CPH, and HCG were used to induce spawning of the milkfish. A total of 22 potentially receptive females were injected. Females with oocytes 0.7 mm in diameter or above offer the greatest chance for success. A priming dose of hormone injected immediately after capture reduces the effects of stress oratresia. Under optimal conditions, the spawning of milkfish can be induced by two or three injections of total dose up to 200 mg CPH with 25,000 IU HCG. Mature females respond more readily to injections without the added stress of salinity adjustment.

80-000022 Lesser, W.; Vilstrup, R. THE SUPPLY AND DEMAND FOR YELLOW PERCH 1915-1990. Univ. Wis. Coll. Agric. Life Sci. Res. Bull. R3006. 14p. Apr. 1979. SFA 25(1)
[Agric. Econ., Cornell Univ., Ithaca, NY]

80-000023 Liao, I-C.; Juario, J. V.; Kumagai, S.; Nakajima, M.; Natividad, M.; Buri, P. ON THE INDUCED SPAWNING AND LARVAL REARING OF MILKFISH, /CHANOS CHANOS/ (FORSKAL). Aquaculture 18 (2): 75-93. Oct. 1979. SFA 25(1)
[Tungkang Mar. Lab., Tungkang, Pingtung 916, Taiwan] A female milkfish, captured at sea, was injected with two hormonal injections of acetone-dried salmon pituitary powder and human chorionic gonadotropin, plus Vitamin B complex. It was stripped, and produced 128,000 ripe eggs with an average diameter of 1.15 mm. Fertilization

80-000023 CONTINUED
rate was 38 percent following artificial fertilization with milt from an uninjected male. A total of 36,000 larvae hatched (74 percent of fertile eggs) after 26-32 h at 34 °/oo salinity and 27-32°C. The newly hatched larvae measured 3.4 mm in mean total length and possessed a large yolk sac. The mouth of the larvae opened about 54 h after hatching. The larvae were fed with fertilized oyster eggs, rotifers, copepods, brine shrimp, flour and prepared feed, together with /Chlorella/. A critical period was between the 4th and 6th days with mortality over 80 percent. The larvae started increasing in length by Day 8, and had the appearance of the wild fry by Day 11. On Day 13 a pigmentation pattern developed and the biggest larva measured 10.0 mm. By Day 18 the larvae measured 12.5 mm, and 14.5 mm by Day 21. A total of 2,859 fry was obtained; the highest larval survival rate obtained from different experimental groups was 46.8 percent.

80-000024 Rappaport, U.; Sarig, S. THE EFFECT OF POPULATION DENSITY OF CARP IN MONOCULTURE UNDER CONDITIONS OF INTENSIVE GROWTH. Bamidgeh 31 (2): 26-34. June 1979. SFA 25(1)
[Intensive Fish Cult. Stn., Fish. Dep., Ginosar, Israel] The effect of stocking carp at densities of 20,000, 16,000, 13,000, 7,000 and 4,000 fish/ha under intensive growth conditions was tested on growth rate and rentability. It was proved that reduction of stocking density from 20,000 to 4,000 carp/ha resulted in: a) in increased individual daily growth rate of up to 55 percent; b) a drop of 17-33 percent in FCR. A density of 4,000 fish/ha in comparison with the higher density of 20,000 resulted in: a) a 68 percent drop in daily growth increment perunit area; b) a yield of 3,210 kg for 153 days of growth at a density of 4,000 fish/ha, as against 10,100 kg at a density of 20,000. The net income per ha (without subtracting interest and depreciation expenses) increased by 56 percent in the most extreme case (stocking rate of 1,600) in comparison with that at a stocking density of 4,000 fish/ha.--Summ.

80-000025 Romaire, R. P.; Boyd, C. E. EFFECTS OF SOLAR RADIATION ON THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PONDS. Trans. Am. Fish. Soc. 108 (5): 473-478. Sept. 1979. SFA 25(1)
[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

80-000026 Schachte, J. H., Jr. IODOPHOR DISINFECTION OF MUSKELLUNGE EGGS UNDER INTENSIVE CULTURE IN HATCHERIES. Prog. Fish-Cult. 47 (4): 189-190. Oct. 1979. SFA 25(1)
[N.Y. State Dep. Environ. Conserv., Fish Dis. Control Unit, 8314 Fish Hatchery Rd., Rome 13440]

80-000027 Srivastava, J. B.; Chowdhary, S. K. CULTURE OF /CATLA CATLA/ IN A LENTIC IMPOUNDMENT IN JAMMU. Aquaculture 18 (3): 283-285. Nov. 1979. SFA 25(1)
[Div. Rural Technol., Reg. Res. Lab. (C.S.I.R.), Canal Rd., Jammu Tawi, India] In May 1977, fry of /Catla catla/ was introduced for the first time by the Regional Research Laboratory, Jammu, for culturing in the inland waters of the region. One hundred tagged speciments and 250 untagged ones were stocked along with Indian major and Chinese carps in a rain- and partially sewage-fed impoundment having an area of 2.5 ha and depth ranging from 1.50 m to 3.25 m. Tagged specimens were caught by a cast net in July 1978. The average mean weight recorded was 4,750 g and the average mean length was 58.6 cm after 14 months. The largest specimen was 7,500 g in weight and 63.00 cm in length and the smallest 4,000 g in weight and 55.00 cm in length. The pond bloomed naturally with both phyto- and zooplankton throughout the

80-000027 CONTINUED
year, and no supplementary feed or fertilizer was provided.

80-000028 Tucker, L.; Boyd, C. E.; McCoy, E. W. EFFECTS OF FEEDING RATE ON WATER QUALITY, PRODUCTION OF CHANNEL CATFISH, AND ECONOMIC RETURNS. Trans. Am. Fish. Soc. 108 (4): 389-396. July 1979. SFA 25(1)
[Auburn Univ. Agric. Exp. Stn., Auburn Univ., Auburn, AL 36830]

MARICULTURE

80-000029 Fortes, R. D. EVALUATION OF TENPOUNDER AND TARPON AS PREDATORS ON JAVA TILAPIA IN BRACKISHWATER PONDS IN THE PHILIPPINES. Ph.D. dissertation, Auburn Univ. 98p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(3):998. Sept. 1979. SFA 25(1)
Experiments were conducted in 500-m² ponds of the Univeristy of the Philippines to evaluate tenpounder (/Elops hawaiiensis/ Regan) and tarpon (/Megalops cyprinoides/ Broussone) as predators on Java tilapia (/Tilapia mossambica/ Peters). Tenpounder or tarpon-tilapia ratios of 0:1; 1:0; 1:5; 1:10 and 1:20 were tested in 4-month trials. Both tenpounder and tarpon reduced young tilapia populations and total production. The tenpounder tended to prey on original stocks of tilapia reducing the production of marketable fish. When stocked at sizes of 6 to 30 g, tenpounder appeared not to prey on tilapia fry. Tarpon, however, when stocked at sizes of 2 to 24 g, preyed on young tilapia and apparently did not prey upon the original stocks; thus more marketable tilapia were produced. The ratios 1:10 and 1:20 (tenpounder: tilapia) were promising, while the ratio 1:10 (tarpon: tilapia) was established to be the most desirable for tarpon. An interval of approximately 18 days between stocking of tilapia and predators was needed to prevent predation on original stocks. Milkfish-mixed sexes tilapia polyculture produced 283 kg/ha of milkfish, whereas, only 231 kg/ha of milkfish was produced in the milkfish-male tilapia combination. Total production in the former was higher (343 kg/ha) than in the latter (322 kg/ha). All-male tilapia culture produced 113 kg/ha marketable tilapia, whereas, only 40 and 51 kg/ha of marketable tilapia were produced from a mixed-sex tilapia monoculture and from a tarpon-mixed sexes tilapia combination, respectively. Polyculture of milkfish and mixed-sex tilapia with predator appeared to be more desirable than milkfish-male tilapia polyculture for milkfish production.--From abstr.

80-000030 McGlew, P. A.; Brown, D. E. LEGAL AND INSTITUTIONAL FACTORS AFFECTING MARICULTURE IN TEXAS. Coast. Zone Manage. J. 6 (1): 69-88. 1979. SFA 25(1)
[McGlew and Brown, Attorneys at Law, Austin, TX] Aquaculture and its specialized cousin, mariculture, provide some potential additional food sources and economic revenues. Technological barriers to increased mariculture production are being removed, but many legal and institutional barriers remain. Examples of the current and potential regulation of mariculture in Texas by state and federal authorities are examined. The effect of various state and federal regulations on the development of mariculture is discussed from a legal and institutional viewpoint. The potential for growth of mariculture is considered questionable without regulatory reforms, particularly at the federal level.

80-000031 Otte, G.; Rosenthal, H. MANAGEMENT OF A CLOSED BRACKISH WATER SYSTEM FOR HIGH-DENSITY FISH CULTURE BY BIOLOGICAL AND CHEMICAL WATER TREATMENT. Aquaculture 18 (2): 169-181. Oct. 1979. SFA 25(1)

[Biol. Anst. Helgoland, Zentiale Hamburg, Palmaille 9, D-2000 Hamburg 50, West Germany] During a 1-year operation of a warm water recycling system (salinity about 8 °/oo) sufficient water quality was maintained under high stocking density conditions using /Tilapia/ and the European eel as potential candidates for intensive farming. The final fish: water ratio was 1:23 (or 43.5 g fish per 1 water) for the whole experimental culture unit. The total water volume of the system was about 5 m^3. The water treatment unit held 52 percent of the total volume, whereby 46 percent was available for fish culture. Combined biological (trickling filter with Hydropack-foil) and chemical (ozonation) water treatment proved to be useful to meet water quality requirements under these rearing conditions. After an initial conditioning period of the biofilter, BOD varied from 4.5 to 6.0 mg O(2)/l, ammonium levels were maintained at less than 1 mg/l and nitrite concentrations averaged 1 mg/l. The average efficiency (oxidation rate) of the biofilter for NH(4)+- and NO(2)--oxidation was 31 percent and 13.2 percent, respectively. The pH was stabilized slightly above 7.0 when a denitrification unit was connected to the system. Nitrate concentration of the system levelled off between 200 and 400 mg/l and was regulated by the addition of an electron donator (first glucose solution, then methanol) to the denitrificaiton unit; the elimination rate averaged 50 percent with a maximum of 98 percent. High nitrite levels were avoided by ozone treatment of the recycled water. The accumulation of low-biodegradable substances was also successfully counteracted by ozonation. Fish growth rates of about 30 percent per month at high stocking densities were reached for /Tilapia/ at a fish:water ratio of 1:4.6 (217 g fish per 1 water), indicating that a combination of biological water treatment and ozonation supports intensive fish culture in a closed aquaculture system.

FEEDS, FEEDING AND NUTRITION

80-000032 Austreng, E.; Refstie, T. EFFECT OF VARYING DIETARY PROTEIN LEVEL IN DIFFERENT FAMILIES OF RAINBOW TROUT. Aquaculture 18 (2): 145-156. Oct. 1979. SFA 25(1)

[Dep. Poultry Fur Anim. Sci., Agric. Univ. Norway, 1432 As-NLH, As, Norway] Groups of rainbow trout (/Salmo gairdneri/) fingerlings from five different families and five inbred groups were fed for 153 days on each of four diets similar in energy content, but differing in their percentage of protein. The protein contents were 24, 33, 42 and 51 percent, respectively. Significant differences between fish families were found for growth, condition factor, chemical composition of the carcass, and digestibility of protein. At the end of the experiment, interaction between diet fed and family was found close to significance for weight and relative growth rate, and significant for length and condition factor. This interaction indicates that prospects for selectively breeding strains of rainbow trout specifically better able to utilize protein are promising. Fish growth rate increased with increasing dietary protein content. The corresponding conditon factor, content of dry matter and energy in the carcass decreased. The high protein diets gave more protein in the carcass and a more discoloured liver than the low protein diets. Apparent protein digestibility increased with increasing protein level.

80-000033 Bergot, F. CARBOHYDRATE IN RAINBOW TROUT DIETS: EFFECTS OF THE LEVEL AND SOURCE OF CARBOHYDRATE AND THE NUMBER OF MEALS ON GROWTH AND BODY COMPOSITION. Aquaculture 18 (2): 157-167. Oct. 1979. SFA 25(1)

[Inst. Natl. Rech. Agron., Lab. Nutr. Poissons, Cent. Rech. Hydrobiol., Saint Pee-sur-Nivelle, 6431 Ascain, France]

Isonitrogenous rations containing various levels of digestible carbohydrate were fed to groups of trout for 8 weeks. Two levels (15 or 30 percent) and two sources (glucose or starch) of carbohydrates were used. A given amount of 30 percent glucose diet was distributed in either 2, 4 or 6 meals/day, to determine the effect of meal frequency. Growth, feed efficiency and body composition of the different groups were compared. Glycaemia levels, as influenced by the different dietary treatments, were measured immediately and 6 h after a given meal. The 30 percent glucose diet promoted the best weight gain, feed conversion and protein efficiency. Groups fed the 15 percent glucose diet gave values between those of 30 percent glucose and the 30 percent starch-fed groups. The additional energy retained in groups fed the highest glucose level (30 percent) did not modify carcass composition but increased fat deposits in the viscera and glycogen in the liver. Plasma glucose levels indicated that the regulation of glycaemia is effective within a 24-h period, even after a daily intake of 550 mg glucose/100 g body weight. Increasing the number of meals had no discernible effect, the efficiency of the 30 percent glucose diet being the same in the various groups. It is concluded that, under certain experimental conditions, trout can tolerate up to 30 percent glucose in the diet and can use it for energy needs.

80-000034 Bergot, F. EFFECTS OF DIETARY CARBOHYDRATES AND OF THEIR MODE OF DISTRIBUTION ON GLYCAEMIA IN RAINBOW TROUT (/SALMO GAIRDNERI/ RICHARDSON). Comp. Biochem. Physiol. A Comp. Physiol. 64 (4): 543-547. 1979. SFA 25(1)

[Lab. Nutr. Poissons, Cent. Rech. Hydrobiol., I.N.R.A., B.P. 3, Saint Pee sur Nivelle, 64310 Ascain, France]

80-000035 Chervinski, J.; Lahav, M. FRESH WATER FEED OF YOUNG EUROPEAN SEA BASS (/DICENTRARCHUS LABRAX/ L.). Bamidgeh 31 (2): 44-48. June 1979. SFA 25(1)

[Fish Aquacult. Res. Stn., Dor, Israel]

80-000036 Choubert, G., Jr.; Luquet, P. INFLUENCE DE L'AGGLOMERATION ET DU STOCKAGE DES ALIMENTS COMPOSES SUR LEUR TENEUR EN CANTHAXANTHINE: CONSEQUENCES SUR LA DIGESTIBILITE ET LA FIXATION DE CE PIGMENT CHEZ LA TRUITE ARC-EN-CIEL. [CANTHAXANTHIN CONTENT OF FEED CONCENTRATES AS AFFECTED BY PELLETING AND STORAGE PROCESSES: CONSEQUENCES ON DIGESTIBILITY AND PIGMENTATION OF THE RAINBOW TROUT.] Ann. Zootech. 28 (2): 145-157. 1979. In French with English summ. SFA 25(1)

[Lab. Nutr. Poissons, I.N.R.A., St-Pee-sur-Nivelle, 64310 Ascain, France]

80-000037 Dabrowska, H.; Grudniewski, C.; Dabrowski, K. ARTIFICIAL DIETS FOR COMMON CARP: EFFECT OF THE ADDITION OF ENZYME EXTRACTS. Prog. Fish-Cult. 47 (4): 196-200. Oct. 1979. SFA 25(1)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., Olsztyn, Poland]

80-000038 Dabrowski, K.; Kozak, E. THE USE OF FISH MEAL AND SOYABEAN MEAL AS A PROTEIN SOURCE IN THE DIET OF GRASS CARP FRY. Aquaculture 18 (2): 107-114. Oct. 1979. SFA 25(1)
[Inst. Ichthyol. Fish., Acad. Agric. Technol., 10-957 Olsgtyn-Kortavo, Poland] Diets based on fish meal and soyabean meal were fed to grass carp fry, the average body weight of each individual being 0.4 g. During the 70 days of the experiment, the best results were obtained with a diet containing 40 percent fish meal, when growth increment, protein efficiency ratio and apparent net protein utilization amounted to 209, 1.26 and 20.3 respectively. There was a deficiency in sulphuric amino acids in both fish meal- and soyabean meal-containing diets, and this was particularly marked in the latter. A significant decrease in available lysine was found in the diets containing soyabean meal. The main reason for the retardation in fish growth and the reduction of protein utilization when soyabean meal content is increased in the diets, seemed to be that the destruction of anti-nutritional factors by the heat processing of the meal was only partial.

80-000039 Fedorov, K. Ye.; Bogdanova, L. S. THE GROWTH AND DEVELOPMENT OF THE LARVAE OF THE PINK SALMON, /ONCORHYNCHUS GORBUSCHA/, UNDER DIFFERENT TEMPERATURE AND FEEDING REGIMES. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 568-576. 1978. SFA 25(1)
[Dep. Ichthyol. Hydrobiol., Leningrad Univ., USSR] Growth, development and state of the digestive system of the larvae of the pink salmon, /Oncorhynchus gorbuscha/, was studied during the time of mixed feeding and with different combinations of two factors: temperature (5-6° and 10-11°) and retardation of the start of feeding by 15, 30, 45 and 60 days.

80-000040 Greenland, D. C.; Gill, B. L. MULTIPLE DAILY FEEDINGS WITH AUTOMATIC FEEDERS IMPROVE GROWTH AND FEED CONVERSION RATES OF CHANNEL CATFISH. Prog. Fish-Cult. 41 (3): 151-153. July 1979. SFA 25(1)
[U.S. FWS, Fish Farm. Exp. Stn., P.O. Box 860, Stuttgart, AR 72160]

80-000041 Howell, B. R. EXPERIMENTS ON THE REARING OF LARVAL TURBOT, /SCOPHTHALMUS MAXIMUS/ L. Aquaculture 18 (3): 215-225. Nov. 1979. SFA 25(1)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, England] Experiments on the live food requirements of cultured turbot larvae are described. A mixture of six species of unicellular algae did not sustain early larvae, but the growth and survival of larvae fed with rotifers were considerably improved when the rotifers were feeding on /Isochrysis galbana/ rather than on /Dunaliella tertiolecta/. Oyster (/Crassostrea gigas/) larvae offered alone or with rotifers, did not produce higher larval growth or survival than rotifers alone. Black tanks were found to be more suitable than white tanks for rearing larval turbot.

80-000042 Imada, O.; Nageyama, Y.; Watanabe, T.; Kitajima, C.; Fujita, S.; Yone, Y. [DEVELOPMENT OF A NEW YEAST AS A CULTURE MEDIUM FOR LIVING FEEDS USED IN THE PRODUCTION OF FISH SEED.] Bull. Jpn. Soc. Sci. Fish. 45 (8): 955-959. Aug. 1979. In Japanese with English summ. SFA 25(1)
[Kyowa Hakko Kagyo Co., Ltd., Ohtemachi, Chiyoda-ku, Tokyo 100, Japan]

80-000043 Kilambi, R. V.; Robison, W. H. EFFECTS OF TEMPERATURE AND STOCKING DENSITY ON FOOD CONSUMPTION AND GROWTH OF GRASS CARP /CTENOPHARYNGODON IDELLA/, VAL. J. Fish Biol. 15 (3): 337-342. Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Ark., Fayetteville 72701] Grass carp were raised in 227 l indoor tanks at 12.8, 18.3, 23.9 and 29.4°C temperatures, each experimental condition received five fish. Five grass carp were also raised in a 1135 l tank maintained at 29.4°C representing low stocking density (29.4°C-L). Food consumption, food conversion, and growth of carp were not different among the 18.3, 23.9, and 29.4°C experimental conditions with identical stocking density. The least growth and food consumption were noted for the fish at the 12.8°C temperature. The fish at the low stocking density had the best growth and maximum food consumption.

80-000044 Mac, M. J.; Nicholson, L. W.; McCauley, C. A. PCBS AND DDE IN COMMERCIAL FISH FEEDS. Prog. Fish-Cult. 41 (4): 210-211. Oct. 1979. SFA 25(1)
[U.S. FWS, Great Lakes Fish. Lab., 1451 Green Rd., Ann Arbor, MI 48105]

80-000045 Mazid, M. A.; Tanaka, Y.; Katayama, T.; Rahman, M. A.; Simpson, K. L.; Chichester, C. O. GROWTH RESPONSE OF /TILAPIA ZILLII/ FINGERLINGS FED ISOCALORIC DIETS WITH VARIABLE PROTEIN LEVELS. Aquaculture 18 (2): 115-122. Oct. 1979. SFA 25(1)
[Dep. Fish. Technol., Bangladesh Agric. Univ., Mymensingh, Bangladesh] Six purified casein diets within a range of 21-53 percent crude protein were fed for 3 weeks to young tilapia (/Tilapia zillii/) to determine the optimum protein requirement and protein: energy ratio for growth. Growth rate increased proportionally to protein level of the diet to an incorporation rate of about 35 percent. Beyond this a gradual retardation in growth rate was observed. The diet containing about 30 percent crude protein with a protein: energy (P/E) ratio of 81, however, appeared to be more efficiently utilized by the fish in terms of protein deposition and energy retention than diets with higher levels of crude protein. These results indicate that /Tilapia zillii/ requires about 35 percent protein in the diet for optimum growth while 30 percent for the maximum bodily protein deposition when casein is used as the sole source of protein. All six diets, however, showed an excellent feed conversion. Protein efficiency ratio (PER) decreased with the increase in protein in the diet.

80-000046 Murray, M. W.; Andrews, J. W. CHANNEL CATFISH: THE ABSENCE OF AN EFFECT OF DIETARY SALT ON GROWTH. Prog. Fish-Cult. 41 (3): 155-156. July 1979. SFA 25(1)
[Univ. Ga. Coll. Agric., Coastal Plain Stn., P.O. Box 13687, Savannah 31406]

80-000047 Ogino, C.; Yang, G.-Y. [REQUIREMENT OF CARP FOR DIETARY ZINC.] Bull. Jpn. Soc. Sic. Fish. 45 (8): 967-969. Aug. 1979. In Japanese with English summ. SFA 25(1)

[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan] Carp weighing 1.9 g and 1.5 g on the average were fed purified diets containing different amounts of zinc for 12 and 16 weeks, respectively. The rearing water contained zinc at a level of 10 ug per l. Dietary zinc levels were found to affect not only the appetite, growth rate, and mortality of the carp, but also the levels of zinc, iron, and copper in the tissues. The fish fed the diet containing 1 ppm zinc suffered from erosion of the skin and the fins. The requirement of carp for dietary zinc was proved to be 15 to 30 ppm of the dry diet under the present experimental conditions.

80-000048 Pfeffer, E.; Meske, C. H. UNTERSUCHUNGEN ZUR ERMITTLUNG DES BEDARFS AN MINERALISCHEN MENGENELEMENTEN VON SPIEGELKARPFEN (/CAPRINUS CARPIO/). [DERIVING REQUIREMENTS OF MAJOR MINERAL ELEMENTS IN CARP (/CAPRINUS CARPIO/).] J. Anim. Physiol. Anim. Nutr. 42 (5): 225-231. Nov. 1979. In German with English summ. SFA 25(1)

[Inst. Tierernahrung, Univ. Bonn, West Germany] Carp (/Cyprinus carpio/) weighing on average 100 g at the beginning of the trial were fed a diet of 30 percent casein, 10 percent oil and more than 50 percent gelatinized starch. Between 0 and 8 percent ash of fish meal were included as the only source of minerals. Feed conversion and retention of minerals showed no differences due to differences in dietary mineral content.

80-000049 Reddy, S. R.; Katre, S. GROWTH RATE AND CONVERSION EFFICIENCY OF THE AIR-BREATHING CATFISH, /HETEROPNEUSTES FOSSILIS/, IN RELATION TO RATION SIZE. Aquaculture 18 (1): 35-40. Sept. 1979. SFA 25(1)

[Dep. Zool., Bangalore Univ., Bangalore 560001, India] Effects of different feeding rates (0-20 percent live body weight) on food intake, growth and conversion efficiency of /Heteropneustes fossilis/ were studied using the oligochaete worm /Tubifex tubifex/ as food. An amount of worm substance equivalent to 12.73 percent live body weight/fish day^{-1} represents the maximum amount which a 4.015 ± 0.340 g /H. fossilitis/ can consume under laboratory conditions. Geometrically derived feeding rations of 12, 40 and 130 mg/g live fish day^{-1} represent the maintenance, optimum and maximum levels for /H. fossilis/. the SDA (specific dynamic action) increased from 14 mg/g day^{-1} at optimum to 70 mg/g day^{-1} at maximum feeding rate.

80-000050 Sakamoto, S.; Yone, Y. MINERAL MIXTURE IN PURIFIED DIET FOR RED SEA BREAM. Bull. Jpn. Soc. Sci. Fish. 45 (7): 873-877. July 1979. SFA 25(1)

[Fish. Res. Lab., Kyushu Univ., Tsuyasaki, Fukuoka 811-33, Japan]

80-000051 Scott, A. P.; Middleton, C. UNICELLULAR ALGAE AS A FOOD FOR TURBOT (/SCOPHTHALMUS MAXIMUS/ L.) LARVAE--THE IMPORTANCE OF DIETARY LONG-CHAIN POLYUNSATURATED FATTY ACIDS. Aquaculture 18 (3): 227-240. Nov. 1979. SFA 25(1)

[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, England] The production of juvenile turbot in research and commercial practice still involves the use of live foods for the early larvae. The rotifer /Brachionus plicatilis/ is used for the first few days followed by nauplii of the brine shrimp, /Artemia salina/. During this live food phase, the addition of live unicellular algae to the rearing tanks improves the growth and survival of the turbot larvae. Within 10 days

80-000051 CONTINUED
of the start of feeding, large differences in growth rate become apparent depending on the presence or absence of particular algae. The use of /Dunaliella tertiolecta/ in particular results in stunted growth and high mortalities. Evidence is presented in this paper that /Dunaliella tertiolecta/ is not toxic, and that its failure to support turbot larval growth is probably due to a deficiency of long-chain polyunsaturated fatty acids. These compounds have been shown by other workers to be an essential dietary requirement in O-group turbot.

80-000052 Smith, C. E.; Osborne, M. D.; Piper, R. G.; Dwyer, W. P. EFFECT OF DIET COMPOSITION ON PERFORMANCE OF RAINBOW TROUT BROOD STOCK DURING A THREE-YEAR PERIOD. Prog. Fish-Cult. 47 (4): 185-188. Oct. 1979. SFA 25(1)
[U.S. FWS, Fish Cult. Dev. Cent., Bozeman, MT 59715]

80-000053 Steffens, W.; Albrecht, M.-L. ERNIEDRIGUNG DES ANTEILS VON TIERISCHEM PROTEIN IM FUTTER FUER REGENBOGENFORELLEN (/SALMO GAIRDNERI/). 2. MITTEILUNG. ERGAENZUNG DURCH METHIONIN UND LYSIN. [REDUCING THE PROPORTION OF ANIMAL PROTEIN IN FEED FOR RAINBOW TROUT (/SALMO GAIRDNERI/). 2. SUPPLEMENTATION OF METHIONINE AND LYSINE.] Arch. Tierernaehr. 29 (5): 339-347. May 1979. In German with English and Russian summ. SFA 25(1)
[Inst. Binnenfisch., Berlin, Germany]

80-000054 Takeuchi, T.; Watanabe, T.; Ogino, C. [AVAILABILITY OF CARBOHYDRATE AND LIPID AS DIETARY ENERGY SOURCES FOR CARP.] Bull. Jpn. Soc. Sci. Fish. 45 (8): 977-982. Aug. 1979. In Japanese with English summ. SFA 25(1)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000055 Takeuchi, T.; Watanabe, T.; Ogino, C. [OPTIMUM RATIO OF DIETARY ENERGY TO PROTEIN FOR] Bull. Jpn. Soc. Sci. Fish. 45 (8): 983-987. Aug. 1979. In Japanese with English summ. SFA 25(1)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

TRANSPORTING FISH

80-000056 Aldrin, J. F.; Messager, J. L.; Mevel, M. ESSAI SUR LE STRESS DE TRANSPORT CHEZ LE SAUMON COHO JUVENILE (/ONCORHYNCHUS KISUTCH/). [A STUDY OF TRANSPORT STRESS IN JUVENILE COHO SALMON (/ONCORHYNCHUS KISUTCH/).] Aquaculture 17 (4): 279-289. Aug. 1979. In French with English summ. SFA 25(1)
[Minist. Agric., B.P. 337, 29273 Brest Cedex, France] The mean values of eight blood parameters in a population of freshwater juvenile coho salmon were compared before and after transportation. All parameters were affected immediately following 3 h transportation with final hypoxia: haematrocrit, haemoglobin, total plasma protein, total cholesterol, and Na^+ increased. Cl^- and K^+ decreased. The mean glucose value was not greatly modified; however, some individuals showed very high values, while others showed very low values. This peculiar finding may be due to the low nutritional level of the population (hypoglycaemic individuals probably having exhausted their glycogen stores). After 8 days the parameters had returned to their initial levels, with the exception of Na^+ and chlolesterol. Identical

80-000056 CONTINUED
results were found 1 month later. Following a formalin-malachite green bath treatment, parameter modification resembled that observed after transportation except for Na^+ and K^+, which remained relatively unchanged.

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

80-000057 Allen, S. K., Jr.; Stanley, J. G. POLYPLOID MOSAICS INDUCED BY CYTOCHALASIN B IN LANDLOCKED ATLANTIC SALMON /SALMO SALAR/. Trans. Am. Fish. Soc. 108 (5): 462-466. Sept. 1979. SFA 25(1)
[Me. Coop. Fish. Res. Unit, Univ. Me., Orono 04469]

80-000058 Choubert, G., Jr. TENTATIVE UTILIZATION OF SPIRULIN ALGAE AS A SOURCE OF CAROTENOID PIGMENTS FOR RAINBOW TROUT. Aquaculture 18 (2): 135-143. Oct. 1979. SFA 25(1)
[Cent. Rech. Hydrobiol., INRA, Lab. Nutr. Poissons, B.P. 3, Saint Pee-sur-Nivelle, 64310 Ascain, France]

80-000059 Fagerlund, U. H. M.; McBride, J. R.; Stone, E. T. A TEST OF 17 ALPHA-METHYLTESTOSTERONE AS A GROWTH PROMOTER IN A COHO SALMON HATCHERY. Trans. Am. Fish. Soc. 108 (5): 467-472. Sept. 1979. SFA 25(1)
[Resour. Serv. Br., Dep. Fish. Oceans, Vancouver, BC V7V 1N6, Canada]

80-000060 Geving, S. A.; Bathel, D. D. EFFICIENT TOOL FOR SEPARATING LIVE SALMONID SAC FRY FROM DEAD EGGS AND FRY. Prog. Fish-Cult. 41 (4): 195. Oct. 1979. SFA 25(1)
[Minn. Dep. Nat. Resour., French River Coldwater Hatchery, 10033 North Shore Dr., Duluth, MN 55804]

80-000061 Goetz, F. W.; Donaldson, E. M.; Hunter, G. A.; Dye, H. M. EFFECTS OF ESTRADIOL-17 BETA AND 17 ALPHA-METHYLTESTOSTERONE ON GONADAL DIFFERENTIATION IN THE COHO SALMON, /ONCORHYNCHUS KISUTCH/. Aquaculture 17 (4): 267-278. Aug. 1979. SFA 25(1)
[Dep. Biol., Univ. Notre Dame, Notre Dame, IN 46556] Methods are described for controlling sex differentiation in the coho salmon, /Oncorhynchus kisutch/. Eyed eggs and alevins were immersed in solutions of estradiol-17 beta and 17 alpha-methyltestosterone and fed these steroids in the diet for a period of 10 weeks postswim-up. In seven out of 10 groups that received estradiol all fish resembled normal females when sampled at 4 months posthatch. In fish treated with methyltestosterone at all except the lowest dose (25 and 50 ug/l) the gonads resembled neither normal males nor normal females; these gonads were composed largely of connective tissue with only occasional germ cells. Various proportions of male, female and intersex gonads were observed in groups which received androgen or estrogen only in the diet. The implications of the work for salmon culture include the production of sterile fish and increasing the proportion of female salmon in hatchery populations.

SPORT FISHERY ABSTRACTS

80-000062 Plichta, E. H.; Pratschner, G. A. CLEANING RACEWAYS WITH A CONCRETE GRINDER. Prog. Fish-Cult. 41 (3): 140-141. July 1979. SFA 25(1)
[Wolf Creek Natl. Fish. Hatchery, Jamestown, KY 42629]

80-000063 Shafland, P. L.; Davis, J. W.; Koehl, D. H. METHOD FOR COLLECTING ZOOPLANKTON FOR FEEDING LARVAL FISHES. Prog. Fish-Cult. 47 (4): 204-205. Oct. 1979. SFA 25(1)
[Fla. Game Fresh Water Fish Comm., Boca Raton 33431]

80-000064 Spanier, E. EXPERIMENTS IN REPELLING NIGHT HERONS FROM FISH PONDS BY THE USE OF DISTRESS CALLS. Proc. Sci. Conf. Isr. Ecol. Soc. 10: C1-C18. June 1979. SFA 25(1)
[Inst. Evol., Univ. Haifa, Haifa, Israel]

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-000065 Jonasson, P. M. , (ed.) ECOLOGY OF EUTROPHIC, SUBARCTIC LAKE MYVATN AND THE RIVER LAXA. Oikos 32 (1/2): 1-308. 1979. SFA 25(1)
[Freshwater Biol. Lab., Univ. Copenhagen, Hillerod, Denmark] A collection of 19 papers.

80-000066 Stockner, J. G.; Shortreed, K. S. LIMNOLOGICAL STUDIES OF 13 SOCKEYE SALMON (/ONCORHYNCHUS NERKA/) NURSERY LAKES IN BRITISH COLUMBIA, CANADA. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 865. iv + 125p. Feb. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Pac. Environ. Inst., 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada]

PHYSICAL LIMNOLOGY AND OCEANOGRAPHY

80-000067 Cook, S. K.; Crist, R. W. ESTIMATES OF BOTTOM TEMPERATURE FROM FISH CAPTURED IN LOBSTER TRAPS. Mar. Fish. Rev. 41 (8): 23-25. Aug. 1979. SFA 25(1)
[NMFS, R.R. 7, South Ferry Rd., Narragansett, RI 02882] Preliminary field experiments have shown that the internal body temperature of fish captured in lobster traps is a reasonable indicator of actual bottom temperature if the internal temperature is measured by insertion of a thermistor through the anal vent as soon as the fish is brought on deck, and if the fish captured are over 65 cm (approximately 25 inches) in length. Fish as small as 32 cm (approximately 12.5 inches) can be utilized provided they are caught in isothermal or shallow water (less than 40 m) which involves a short hauling time to the surface. This procedure provides fishermen with an inexpensive technique for determining bottom temperatures.

CHEMICAL LIMNOLOGY AND OCEANOGRAPHY

80-000068 Peters, R. H. CONCENTRATIONS AND KINETICS OF PHOSPHORUS FRACTIONS ALONG THE TROPHIC GRADIENT OF LAKE MEMPHREMAGOG. J. Fish. Res. Board Can. 36 (8): 970-979. Aug. 1979. In English with French summ. SFA 25(1)
[Dep. Biol., McGill Univ., 1205 Ave. Docteur Penfield, Montreal, PQ H3A 1B1, Canada]

80-000069 Prokopowich, J. CHEMICAL CHARACTERIZATION OF EPILIMNION WATERS IN THE EXPERIMENTAL LAKES AREA, NORTHWESTERN ONTARIO. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 873. iv + 41p. Aug. 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., Winnipeg, MB R3T 2N6, Canada]

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80-000070 Wildish, D. J.; Kristmanson, D. D. TIDAL ENERGY AND SUBLITTORAL MACROBENTHIC ANIMALS IN ESTUARIES. J. Fish. Res. Board Can. 36 (10): 1197-1206. Oct. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

PLANKTON

80-000071 Costella, A. C.; Shortreed, K. S.; Stockner, J. G. PHYTOPLANKTON FRACTIONATION STUDIES IN GREAT CENTRAL LAKE, BRITISH COLUMBIA: A NUTRIENT-ENRICHED SOCKEYE SALMON (/ONCORHYNCHUS NERKA/) NURSERY LAKE. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 880. iv + 27p. May 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada]

80-000072 Potter, D. S. THE ZOOPLANKTON OF FLATHEAD LAKE: AN HISTORICAL REVIEW WITH SUGGESTIONS FOR CONTINUING LAKE RESOURCE MANAGEMENT. Ph.D. dissertation, Univ. Mont. 388p. 1978. From Diss. Abstr. Int. B Sci. Eng. 40(3):1058. Sept. 1979. SFA 25(1)

MORPHOLOGY

80-000073 Batten, T. F. C.; Ingleton, P. M.; Ball, J. N. ULTRASTRUCTURAL AND FORMALDEHYDE-FLUORESCENCE STUDIES ON THE HYPOTHALAMUS OF /POECILIA LATIPINNA/ (TELEOSTEI, CYPRINODONTIFORMES). Gen. Comp. Endocrinol. 39 (1): 87-109. Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Sheffield, Western Bank, Sheffield S10 2TN, South Yorkshire, England]

80-000074 Berg, R. E. EXTERNAL MORPHOLOGY OF THE PINK SALMON, /ONCORHYNCHUS GORBUSCHA/, INTRODUCED INTO LAKE SUPERIOR. J. Fish. Res. Board Can. 36 (10): 1283-1287. Oct. 1979. In English with French summ. SFA 25(1)
[Tribal Fish. Biol., P.O. Box 625, Sault Ste. Marie, MI 49783]

80-000075 Berge, P. I. THE CARDIAC ULTRASTRUCTURE OF /CHIMAERA MONSTROSA/ L. (ELASMOBRANCHII: HOLOCEPHALI). Cell Tissue Res. 201 (2): 181-195. 3 Sept. 1979. SFA 25(1)
[Cell. Cardiol. Res. Group, Zool. Lab., Univ. Bergen, Norway]

80-000076 Borkhvardt, V. G. ON THE NATURE OF VERTEBRAL ARCHES IN LAMPREYS (PETROMYZONIDAE). J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 677-682. 1978. SFA 25(1)
[Dep. Vert. Zool., Leningrad Univ., USSR]

80-000077 Branson, B. A. OBSERVATIONS ON THE GROSS ANATOMY OF THE OLFACTORY ORGAN AND EYES IN FIVE GENERA OF AMERICAN BARBELED MINNOWS (PISCES: CYPRINIDAE). Southwest. Nat. 24 (3): 501-507. 15 Sept. 1979. SFA 25(1)
[Dep. Biol. Sci., East. Ky. Univ., Richmond 40475] The gross morphology of the olfactory organ and eye size in 5 genera and 15 species of barbeled cyprinid fishes was analyzed morphometrically. Large size of nostrils and large number of olfactory lamellae are correlated with turbid or silty habitats, whereas smaller nostrils and fewer lamellae are characteristic clear-water species. There does not appear to be much correlation between the size of the olfactory organ and habitat. No species-specific correlation between eye size and habitat was discerned, and there is no apparent correlation between eye size and extent of development in the olfactory organ.

80-000078 Branson, B. A. VARIATION IN THE OLFACTORY ORGAN IN /HYBOPSIS AESTIVALIS/ (PISCES: CYPRINIDAE). Trans. Ky. Acad. Sci. 40 (3/4): 112-121. Sept. 1979. SFA 25(1)
[Dep. Biol. Sci., East. Ky. Univ., Richmond 40475]

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[Abt. Mikrosk. Anat., Anat. Inst. Univ., Martinistr. 52, D-2000 Hamburg 20, West Germany]

80-000080 Buynak, G. L.; Mohr, H. W., Jr. LARVAL DEVELOPMENT OF CREEK CHUB AND FALLFISH FROM TWO SUSQUEHANNA RIVER TRIBUTARIES. Prog. Fish-Cult. 41 (3): 124-129. July 1979. SFA 25(1)
[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603]

80-000081 Buynak, G. L.; Mohr, H. W., Jr. LARVAL DEVELOPMENT OF THE NORTHERN PIKE (/ESOX LUCIUS/) AND MUSKELLUNGE (/ESOX MASQUINONGY/) FROM NORTHEAST PENNSYLVANIA. Proc. Pa. Acad. Sci. 53 (1): 69-73. 1979. SFA 25(1)

[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603] Northern pike (/Esox lucius/) eggs hatched 10 days after fertilization at a mean temperature of 10.9 C. Newly hatched larvae ranged from 7.9 to 8.5 mm total length (TL) (mean = 8.3 mm); standard length ranged from 7.8 to 8.4 mm (mean = 8.2 mm). Fin rays were visible in caudal, pectoral, dorsal, anal, and pelvic fins by 13.4, 15.9, 18.2, 18.2 and 19.2 mm TL, respectively. Transformation to the postlarval phase occurred by 13.2 mm TL and to the late postlarval phase by 19.1 mm TL. after fertilization at a mean temperature of 16.9 C. Newly hatched larvae ranged from 7.9 to 9.2 mm TL (mean = 8.7); standard length was only slightly smaller (less than 0.05 mm). Fin rays were visible in pectoral fins by 11.4 mm TL, dorsal, anal, and caudal fins by 17.4 mm TL, and in the pelvics by 21.8 mm TL. Transformation to the postlarval phase occurred by 14.4 mm TL, and to the late postlarval phase by 21.8 mm TL. Useful characteristics for distinguishing northern pike, muskellunge, and chain pickerel (/E. niger) larvae are preanal and total myomere counts, pigmentation, and snout length.

80-000082 Buynak, G. L.; Mohr, H. W., Jr. LARVAL DEVELOPMENT OF THE BLACKNOSE DACE (/RHINICHTHYS ATRATULUS/) AND LONGNOSE DACE (/RHINICHTHYS CATARACTAE/) FROM A SUSQUEHANNA RIVER TRIBUTARY. Proc. Pa. Acad. Sci. 53 (1): 56-60. 1979. SFA 25(1)

[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603] Eggs of the blacknose dace (/Rhinichthys atratulus/) hatched seven days after fertilization at a mean temperature of 18.5 C. Total length (TL) of newly hatched larvae ranged from 4.9 to 5.7 mm (mean = 5.5 mm) and standard length from 4.7 to 5.7 mm (mean = 5.2 mm). The newly hatched larvae had eyes that were pigmented around the outer margins, a few melanophores on the occipital region of the head, and two dorsal rows of melanophores from the occipital region to slightly beyond midbody. These larvae also had pectoral fin buds, straight urostyles, and incomplete mouths. Transformation to the postlarval phase occurred in larvae 7.2 mm TL and to the late postlarval phase by 14.5 mm TL. Eggs of the longnose dace (/R. cataractae/) hatched six days after fertilization at a mean temperature of 18.3 C. Total length of newly hatched larvae ranged from 5.8 to 6.0 mm (mean = 5.9 mm) and standard length from 5.6 to 5.8 mm (mean = 5.7 mm). The newly hatched larvae were unpigmented, had pectoral fin buds, straight urostyles, and incomplete mouths. Transformation to the postlarval phase occurred by 9.4 mm TL and to the late postlarval phase by 14.0 mm TL. Characteristics useful in distinguishing between blacknose and longnose dace are size, pigmentation, and preanal myomere number in prolarvae. Pigmentation patterns and mouth location can be used to separate older larvae.

80-000083 Christopher, W. E.; Linder, A. D. THE OSTEOCRANIUM OF THE CYPRINID FISH, /ACROCHEILUS ALUTACEUS/. Tebiwa (Misc. Pap. Idaho State Univ. Mus. Nat. Hist.) No. 16. 19p. 15 May 1979. SFA 25(1)

[Dep. Biol., Idaho State Univ., Pocatello 83201]

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[Inst. Biofis., Univ. Fed. Rio de Janeiro, Cidade Univ. 21.910, Rio de Janeiro, Brazil]

80-000085 Derivot, J. H.; Dupe, M.; Godet, R. ANATOMIC FONCTIONNELLE DE L'ORGANE OLFACTIF DE /PROTOPTERUS ANNECTENS/ OWEN (DIPNEUSTES): CONTRIBUTION A LA CONNAISSANCE DU MECANISME D'IRRIGATION DE L'ORGANE OLFACTIF. [FUNCTIONAL ANATOMY OF THE OLFACTORY ORGAN OF /PROTOPTERUS ANNECTENS/ OWEN (DIPNOI): CONTRIBUTION TO THE KNOWLEDGE OF THE MECHANISM OF WATER TRANSPORT THOUGH THE OLFACTORY ORGAN.] Acta Zool. (Stockh.) 60 (4): 251-257. 1979. In French with English summ. SFA 25(1)
[Lab. Neurophysiol., U.E.R. Sci., Nice Valrose, France]

80-000086 Desai, A. K. HISTOLOGICAL STUDIES OF THE LIVER OF MIGRATORY FISH, /HILSA ILISHA/ AND NON-MIGRATORY /HILSA TOLI/. J. Anim. Morphol. Physiol. 25 (1/2): 119-123. June-Dec. 1978. SFA 25(1)
[Dep. Zool., Fac. Sci., M.S. Univ. Baroda, Baroda, 390 002, India]

80-000087 Dobrinskaya, L. A. CORRELATIVE INCREASE IN BODY AND BRAIN WEIGHT IN JUVENILE CARP. Sov. J. Ecol. (Engl. Transl. Ekologiya) 9 (6): 566-569. July 1979. SFA 25(1)
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[Dep. Zool., Univ. Groningen, The Netherlands]

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[Dep. Zool., Univ. Dar es Salaam, P.O. Box 35064, Dar es Salaam, Tanzania]

80-000091 Kagawa, H.; Takano, K. [ULTRASTRUCTURE AND HISTOCHEMISTRY OF GRANULOSA CELLS OF PRE- AND POST-OVULATORY FOLLICLES IN THE OVARY OF THE MEDAKA, /ORYZIAS LATIPES/.] Bull. Fac. Fish. Hokkaido Univ. 30 (3): 191-204. Aug. 1979. In Japanese with English summ. SFA 25(1)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

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[Dep. Zool., Univ. Queensland, St. Lucia, Brisbane, Queensland 4067, Australia]

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[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

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[Dep. Anat., Sch. Med. Sci., Univ. Nev., Reno 89557]

80-000095 Leiby, M. M. LEPTOCEPHALUS LARVAE OF THE EEL FAMILY OPHICHTHIDAE. I. /OPHICHTHUS GOMESI/ CASTELNAU. Bull. Mar. Sci. 29 (3): 329-343. July 1979. SFA 25(1)
[Fla. Dep. Nat. Resour., Mar. Res. Lab., 100 8th Ave. S.E., St. Petersburg 33701] Two hundred fifty-five larvae of /Ophichthus gomesi/, comprising a developmental series from just hatched to metamorphic, are described. Osteological and morphological development is described and illustrated. A method of determining the number of adult precaudal vertebrae from the leptocephali is provided. This will allow more accuracy in leptocephalus-adult comparisons. Two morphologically distinct, premetamorphic stages of ophichthid leptocephali are named and described.

80-000096 Lewis, S. V. A SCANNING ELECTRON MICROSCOPE STUDY OF THE GILLS OF THE AIR-BREATHING CATFISH, /CLARIAS BATRACHUS/ L. J. Fish Biol. 15 (4): 381-384. Oct. 1979. SFA 25(1)
[Dep. Zool., Univ. Malaya, Lembah Pantai, Kuala Lumpur, Malaysia] Using the scanning electron microscope, the gills of the air-breathing catfish, /Clarias batrachus/, have been studied. The overall morphology of the gills are similar to other teleosts. In contrast to water-breathing species, however, microridges are absent from the surfaces of the secondary lamellae and only short microvilli are present. Long, convoluted microridges are present on the epithelial cells of the gill filaments. The possible roles of these structures in relation to water flow are discussed.

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[Ist. Zool. Univ., Via Accad. Albertina, 17, 10123 Torino, Italy]

80-000099 Mallatt, J. SURFACE MORPHOLOGY AND FUNCTIONS OF PHARYNGEAL STRUCTURES IN THE LARVAL LAMPREY /PETROMYZON MARINUS/. J. Morphol. 162 (2): 249-274. Nov. 1979. SFA 25(1)
[Dep. Anat., Univ. Chicago, 1025 E. 57th St., Chicago, IL 60637]

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[IEMEZh, USSR Acad. Sci., Moscow, USSR] Data are given on the adhesiveness of egg membranes of the Russian sturgeon, /Acipenser guldenstadti/, the beluga, /Huso huso/, and the sheap sturgeon, /Acipenser nudiventris/. The microstrucutre of the surface of the egg membranes was studied by the scanning electron microscope. The gelatinous layer of membrane of the mature egg has an adhesive surface and is capable of special movements by means of which this surface clings to the substrate. The swelling of the membranes intensifies the action of these factors, as a result, contact (areas of attachment) originate on the surface of the membrane, guaranteeing the firm attachment of the membrane to the substrate.

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[Sch. Environ. Sci., Plymouth Polytech., Devon, England]

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[M. Whitear: Dep. Zool., Univ. Coll., Gower St., London WC1E 6BT, England]

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[Fak. Biol., Univ. Bielefeld, Postfach 8640, D-4800 Bielefeld 1, West Germany]

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[H. Kryvi: Inst. Anat., Univ. Bergen, Arstadvollen 19, N-5000 Bergen, Norway]

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[Fish. Lab., Fac. Agric., Nagoya Univ., Chikusa, Nagoya, 464, Japan]

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[J. H. Youson: Dep. Zool., Scarborough Coll., Univ. Toronto, West Hill, ON M1C 1A4, Canada]

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[Max Planck-Inst., Hirnforsch. Deutschordenstr. 46, D-6000 Frankfort, West Germany] Adult male guppies adapted to seawater or fresh water were treated for a period of 4 weeks with different doses of prolactin. The epidermis of scales from the midlateral body region was studied by light and electron microscopy. Prolactin treatment of guppies adapted to fresh water changes the pattern of superficial ridges and increases the numbers of cell layers, mucous cells, and subepidermal capillaries. Adaptation to seawater increases the body surface, the surface extent of superficial cells, the number of small electron-dense vesicles, and the height of the glycocalyx. The most striking finding is the occurrence of chloride cells in the epidermis of all guppies adapted to seawater. The number of chloride cells is reduced after low and medium doses of prolactin, and increased following high doses.

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[Max Planck-Inst. Hirnforsch., Deutschordenstr. 46, D-6000 Frankfort, West Germany] The effects of thyroxine and testosterone on the epidermal fine structure of the guppy, /Poecilia reticulata/, are studied by morphometric methods. Treatment with low doses of thyroxine increases the numbers of mucous cells and of small electron-dense vesicles in superficial cells as well as the height of the glycocalyx. Following high doses of thyroxine and testosterone, the guppy epidermis undergoes degenerative changes such as flattening of the epidermal cells, reduction of the glycocalyx-producing organelles, and extreme interdigitation of adjacent superficial cells with reduction of the number of desmosomes.

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[Environ. Conserv. Div., NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

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[Cent. Res. Lab., Med. Inst., Irkutsk, USSR] The results of a histo-morphological study of the alimentary canal of the omul, /Coregonus autumnalis migratorius/, from the Northern Baikal, Posol'skoye and Selenga races are given. Histochemical methods were used for the investigation. A qualitative evaluation is given of the content of mucopolysaccharides in the epithelium and the connective tissue of the alimentary canal.

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[Dep. Zool., Univ. Cambridge, England] The influence of the ground effect on the energetics of hovering in /Synchropus picturatus/ Peters, a negatively buoyant, demersal teleost was studied. Changes in pectoral fin kinematics, the ultimate water velocity in the wake below the fins, the calculated minimum induced thrust and power required to hover are related to the height at which the animal hovers above the substrate. The profile power required to overcome the frictional drag on the fins has been calculated for the case of both a laminar and a turbulent boundary layer over the fins. Reductions in the total power needed to hover (as compared with that required out of ground effect) of 30-60 percent have been calculated /Synchropus/ when hovering at commonly observed heights above the bottom. Results are discussed in relation to the hovering flight of birds, insects and helicopters.

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[Dep. Anim. Sci., Univ. Calif., Davis 95616] The digestive efficiency of /Tilapia zillii/ fed /Najas guadalupensis/ was studied in the laboratory. Digestion was dependent on the ability of the fish to triturate the plant tissues. Based on a dietary reference, cellulose, the total digestibility of /Najas/ was 29.3 percent. Digestive efficiency of the fish for non-cellulose organic matter, protein and fat was 55.7 percent, 75.1 percent and 75.9 percent, respectively. Of the total caloric content of the plant, 45.4 percent was assimilated. An estimate was made of the amount of Najas necessary to satisfy the caloric expenditure of the fish.

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[VNIRO, Moscow, USSR] Data on the metabolic rate of two pelagic species of fish: the horsemackerel, /Trachurus murphyi/, and the butterfish, /Stromateus maculatus/, were obtained on the basis of respiratory experiments carried out on board the research vessel "Akademik Knipovich" in the south-eastern part of the Pacific Ocean. Equations of the metabolism/body weight relationship are given. The age and mean daily growth were calculated from otoliths and scales. The rations for both species were calculated.

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[Inst. Fischforsch. Thaur Univ. Innsbruck, Austria] Oxygen consumption was found to be essentially the same in unfertilized trout eggs, water activated eggs and eggs immediately after fertilization. Trout eggs are capable of regulating the pH of the surrounding medium probably by releasing buffering electrolytes. The electrolyte composition of the coelomic fluid is close to normal vertebrate blood serum. The coelomic fluid may permit further growth of ovulated eggs before spawning.

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Seawater-adapted teleosts drink to offset water loss by osmosis. A direct method of monitoring drinking by implanting a fistula to drain the stomach indicated that rainbow trout began drinking from about 9 to 12 (range 1 to 22) h after being placed in 15‰ sea water. Unlike the Japanese eel (/Anguilla japonica/), in which the onset of drinking has been shown to be immediate and reflex-like, the onset of drinking in trout appears to occur only after appreciable water has been lost to the medium. The trout resembles the eel in that the capacity to swallow water in the absense of postingestional negative feedback exceeds the rate of drinking required to maintain normal water balance.

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[Cardiovascular Res. Lab., U.S.C. Med. Cent., 1200 N. State St., Box 1800, Los Angeles, CA 90033]

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[Lab. Nutr. Poissons, INRA, Cent. Rech. Hydrobiol., Saint-Pee-sur-Nivelle, 64310 Ascain, France]

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[Sch. Biochem., Univ. New South Wales, P.O. Box 1, Kensington, N.S.W. 2033, Australia]

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[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

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[Yale Univ., 290 Congress Ave., New Haven, CT 06519]
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[Zool. Lab., Univ. Leiden, The Netherlands]

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[Zool. Dep., Univ. Calif., Berkley 94720] Ovine Growth hormones elevates serum T(4) in both intact and hypophysectomized /Fundulus heteroclitus/. This activity appears to be an intrinsic property of oGH and is not due to contamination by either oTSH or other glycoprotein hormones. Moreover, while hypophysectomy prevents the oTSH-induced increase in serum T(4) found in intact fish, simultaneous treatment with oGH fully restores the normal response. Unlike oTSH, oGH lacks the ability to elevate thyroidal radioiodine uptake in hypophysectomized /Fundulus/. Thus, oGH appears to act at a level beyond the iodine trap stimulating thyroid function.

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[P. W. Hochachka: Dep. Zool., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

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[Johns Hopkins Univ., Chesapeake Bay Inst., Baltimore, MD 21218]

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[Dep. Biol. Sci., Hunter Coll., New York, NY 10021]

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[Fac. Fish., Kagoshima Univ., Kagoshima 890, Japan]

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[Inst. Zool., Tierarztliche Hochschule Hannover, Bischopholer Damm 15, D-3000 Hannover 1, West Germany]

80-000200 Hofer, R. THE ADAPTATION OF DIGESTIVE ENZYMES TO TEMPERATURE, SEASON AND DIET IN ROACH, /RUTILUS RUTILUS/ AND RUDD /SCARDINIUS ERYTHROPHTHALMUS/; PROTEASES. J. Fish Biol. 15 (4): 373-379. Oct. 1979. SFA 25(1)
[Inst. Zoophysiol., Univ. Innsbruck, Austria] The seasonal changes of proteolytic activity in the gut content of roach /R. rutilus/ and rudd /S. erythrophthalmus/ in four Tyrolean lakes and the adaptation of the proteases to constant temperatures and different natural diets were studied. In rudd proteolytic activity remains nearly constant throughout the year. In roach proteolytic activity increases and then decreases during the first three months after the thaw in spring. This period appears to be endogenously controlled and is followed by a second stage in which proteolytic activity is influenced by environmental factors. Under natural conditions both species have a higher proteolytic activity when feeding on animals than on detritus. Under laboratory conditions there is a slight maximum at an environmental temperature of 16°C when the fish had been fed on meal worms. With plant food a significant dependence of proteolytic activity on environmental temperature was only found in roach.

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[Dep. Zool., Univ. Toronto, Toronto, ON, Canada] A highly significant linear correlation was found between glomerular filtration rate and urine flow rate in both freshwater and seawater trout. The percentage tubular reabsorption of water was approximately 33 percent greater in seawater trout than in freshwater trout. As oxygen consumption increased, the urine flow rate increased in freshwater and seawater rainbow trout. The proportional increase in urine flow with incremental changes in oxygen consumption was approximately the same in fresh water and sea water. A significant positive linear relationship between oxygen consumption and glomerular filtration rate was found in both salinities. The proportional increase in GFR with incremental changes in the oxygen consumption rate was higher in the seawater trout than in the freshwater trout. As oxygen consumption increased, the percentage tubular reabsorption of water decreased in the freshwater trout. No significant relationship between these two factors was found in the seawater trout.

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[Dep. Zoophysiol., Univ. Goteborg, Sweden]

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[Dep. Anat., Loma Linda Univ., Loma Linda, CA 92350]

80-000205 Hopkins, K. D.; Shelton, W. L.; Engle, C. R. ESTROGEN SEX-REVERSAL OF /TILAPIA AUREA/. Aquaculture 18 (3): 263-268. Nov. 1979. SFA 25(1)
[Ala. Coop. Fish. Res. Unit, Auburn Univ., Auburn, AL 36830] Chemical treatments were used to produce sex-reversed female (genetic male) /Tilapia aurea/, which can be bred to produce monosex offspring. Various combinations of estrogens, two synthetic and one natural, an antiandrogen, and a 'pituitary blocking agent' were orally administered to sexually undifferentiated fry. Treatment periods were 4, 5, 6 and 8 weeks. Seven of the 36 treatments produced more than 50 percent females (alpha = 0.05). Two treatments were more successful than the others: (1) 17-alpha-ethynylestradiol (EE) at 100 mg kg^{-1} diet in combination with methallibure (ME) at 100 mg kg^{-1} for 6 weeks and (2) EE-100 with ME-100 and cyproterone acetate (CA) at 100 mg kg^{-1} for 6 weeks. These treatments produced fish that were 90 percent female. Comparisons of the treatments with and without CA indicated that CA may lessen the hormone effectiveness of the treatments. Diethylstilbestrol was as potent as EE in comparable CA treatments.

80-000206 Hori, K.; Fusetani, N.; Hashimoto, K.; Aida, K.; Randall, J. E. OCCURRENCE OF A GRAMMISTIN-LIKE MUCOUS TOXIN IN THE CLINGFISH /DIADEMICHTHYS LINEATUS/. Toxicon 17 (4): 418-424. 1979. SFA 25(1)
[Fac. Fish. Anim. Husb., Hiroshima Univ., Fukuyama, Japan]

80-000207 Hoss, D. E.; Blaxter, J. H. S. THE EFFECT OF RAPID CHANGES OF HYDROSTATIC PRESSURE ON THE ATLANTIC HERRING /CLUPEA HARENGUS/ L. I. LARVAL SURVIVAL AND BEHAVIOUR. J. Exp. Mar. Biol. Ecol. 41 (1): 75-85. 22 Oct. 1979. SFA 25(1)
[NMFS, Beaufort, NC 28516] Larval Atlantic herring (/Clupea harengus/ L.) from 11-39 mm total body length were subjected to different series of pressure changes intended to simulate passage through the cooling water of a thermal power station. This involved both acclimation and rapid pressure increases to 5 atmospheres pressure, followed by rapid decompression. Subsequent mortality, feeding and depth-compensating behaviour were checked as well as the integrity of the gas-filled auditory bulla-swimbladder system which develops between 23-35 mm. There was no evidence of increases in mortality in larvae up to about 20 mm. Larvae from about 25-29 mm showed increased mortality over controls; still larger larvae did not. Larvae which survived the pressure treatment fed as well as controls. There was strong evidence that larvae of all ages attempted to compensate for pressure changes by making appropriate vertical swimming movements. Some of the mortality of the intermediate-sized larvae may be attributed to hyperactivity in a restricted (experimental) space. The bulla membrane in some older larvae was ruptured by the pressure changes. Although this was not immediately a cause of mortality, it would impair mechanical reception in the long term.

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[Res. Unit Comp. Anim. Respir., Bristol Univ., Woodland Rd., Bristol BS8 1UG, England]

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[Dep. Zool., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-000210 Idler, D. R.; Ng, T. B. STUDIES ON TWO TYPES OF GONADOTROPINS FROM BOTH SALMON AND CARP PITUITARIES. Gen. Comp. Endocrinol. 38 (4): 421-440. Aug. 1979. SFA 25(1)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-000211 Iijima, N.; Zama, K. [INFLUENCE OF OXIDIZED LIPIDS ON THE LIPID METABOLISM IN THE FISH. II. ABSORPTION AND METABOLISM OF PALMITIC ACID-1-^{14}C IN CARP FED WITH OXIDIZED LIPIDS.] Bull. Fac. Fish. Hokkaido Univ. 30 (1): 84-91. Feb. 1979. In Japanese with English summ. SFA 25(1)
[Lab. Food Chem., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-000212 Ingoglia, N. A. 4S RNA IS PRESENT IN REGENERATING OPTIC AXONS OF GOLDFISH. Science 206 (4414): 73-75. 5 Oct. 1979. SFA 25(1)
[Dep. Physiol. Neurosci., N.J. Med. Sch., Newark 07103]
Regenerating optic axons of goldfish were loaded with [^{3}H]RNA by injecting [^{3}H]uridine into the eye and allowing time for the radioactivity to be delivered to the optic tectum. The axons were subsequently removed from the tecta by cutting the optic nerve and allowing the optic axons in the tectum to degenerate. Analysis of tectal [^{3}H]RNA by sodium dodecyl sulfate-polyacrylamide gel electrophoresis showed a selective loss of tritiated 4S RNA and not ribosomal RNA from the denervated tecta. These results support the hypothesis that regenerating optic axons of goldfish grow back into the tectum carrying 4S but not ribosomal RNA.

80-000213 Jensen, A. J. ENERGY CONTENT ANALYSIS FROM WEIGHT AND LIVER INDEX MEASUREMENTS OF IMMATURE POLLOCK (/POLLACHIUS VIRENS/). J. Fish. Res. Board Can. 36 (10): 1207-1213. Oct. 1979. In English with French summ. SFA 25(1)
[Dir. Wildl. Freshwater Fish, N-7000 Trondheim, Norway]

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[Dep. Biol., Subdep. Anim. Physiol., Wilhelm-Pieck-Univ. Rostock, 25 Rostock, West Germany]

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[I. M. Sechenov Inst. Evol. Physiol. Biochem., Acad. Sci. USSR, Leningrad, USSR]

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[Kyoto Coll. Pharm., Yamashina, Kyoto 607, Japan]

80-000218 Kaushik, S. J.; Luquet, P. INFLUENCE OF DIETARY AMINO ACID PATTERNS ON THE FREE AMINO ACID CONTENTS OF BLOOD AND MUSCLE OF RAINBOW TROUT (/SALMO GAIRDNERII/ R.). Comp. Biochem. Physiol. B Comp. Biochem. 64 (2): 175-180. 1979. SFA 25(1)
[Lab. Fish. Nutr., Hydrobiol. Res. Cent., I.N.R.A., Saint Pee-sur-Nivelle, 64310 Ascain, France]

80-000219 Kime, D. E. THE EFFECT OF TEMPERATURE ON THE TESTICULAR STEROIDOGENIC ENZYMES OF THE RAINBOW TROUT, /SALMO GAIRDNERI/. Gen. Comp. Endocrinol. 39 (3): 290-296. Nov. 1979. SFA 25(1)
[Dep. Zool., The University, Sheffield, S10 2TN, England]

80-000220 Kirschbaum, F.; Denizot, J. P.; Tsuji, S. ON THE ELECTROMOTOR NEURONS OF BOTH ELECTRIC ORGANS OF /POLLIMYRUS ISIDORI/ (MORMYRIDAE, TELEOSTEI). J. Physiol. (Paris) 75: 429-433. 1979. SFA 25(1)
[Univ. Koln, Zool. Inst. Lehrstuhl 1, Weyertal 119, 5 Koln, West Germany]

80-000221 Kiyashko, V. I.; Volodin, V. M. THE INFLUENCE ON THE EMBRYONIC DEVELOPMENT OF THE RUFFE, /ACERINA CERNUA/, OF THE ACTIVE RESPONSE OF THE ENVIRONMENT. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 693-695. 1978. SFA 25(1)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Reg., USSR]

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[Lab. Fish. Chem., Fac. Agric., Kyushu Univ., Fukuoka 812, Japan]

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[Pavlov Inst. Physiol., USSR Acad. Sci., USSR]

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[Inst. Natl. Rech. Agron., Stn. Rech. Nutr., Cent. Natl. Rech. Zootech., 78350 Jouy-en-Josas, France]

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[Lab. Physiol. Comp. Reg., CNRS, B. P. 20 CR, 67037 Strasbourg-Cedex, France]

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[Dep. Zool., Univ. Calif., Berkeley 94720]

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[H. Wolburg: Inst. Pathol., Liebermeesterstr. 8, D-7400 Tubingen, West Germany]

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[Biosci. Dep., Saurashtra Univ., Rajkot-360005, Gujarat, India]

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[Dep. Zool., Fish Biol. Lab., Univ. Rajasthan, Jaipur-302004, India]
The effect of porcine calcitonin on the plasma calcium of the freshwater Indian murrel, /Channa punctatus/ Bloch has been studied. An injection of 200 MRC mU of porcine calcitonin was given intraperitoneally, while control fish received the gelatin carrier. A significant hypocalcaemia was noted 1 h after calcitonin treatment (P less than 0.001). The plasma calcium had returned to the normal level by the 6th h.

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[Inst. Immunol., Zagreb, Yugoslavia]

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80-000237 McCorkle, F. M.; Chambers, J. E.; Yarbrough, J. D. TOLERANCE OF LOW OXYGEN STRESS IN INSECTICIDE-RESISTANT AND SUSCEPTIBLE POPULATIONS OF MOSQUITOFISH (/GAMBUSIA AFFINIS/). Life Sci. 25 (17): 1513-1518. 22 Oct. 1979. SFA 25(1)
[Dep. Microbiol. Immunol., Univ. Oreg. Health Sci. Cent., Portland]
The tolerance of low oxygen stress in insecticide-resistant and susceptible populations of mosquitofish (/Gambusia affinis/) was investigated. Dissolved oxygen was reduced chemically with formaldehyde and sodium sulfite treatment. Available oxygen was reduced physically through barriers, both by preventing oxygen exchange at the air-water interface and by preventing the fish from contacting the surface of the water. In all cases, the tolerance to low oxygen stress was reduced in the insecticide-resistant population compared to the susceptible population. The results indicate that although tolerance of pesticides in the resistant population has been dramatically increased by environmental selective pressures, tolerance to other stresses has not been concomitantly increased.

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[Inst. Biol. Inland Waters, USSR Acad. Sci., Borak Yaroslavl' Province, USSR]

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[Fac. Fish., Hokkaido Univ., Hakodate, Hokkaido 041, Japan]

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[Univ. Paul Sabatier, Lab. Physiol., 38 Rue des 36 Ponts, 31400 Toulouse, France]

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[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-000246 Niederholzer, R.; Hofer, R. THE ADAPTATION OF DIGESTIVE ENZYMES TO TEMPERATURE, SEASON AND DIET IN ROACH /RUTILUS RUTILUS/ L. AND RUDD /SCARDINIUS ERYTHROPHTHALMUS/ L. CELLULASE. J. Fish Biol. 15 (4): 411-416. Oct. 1979. SFA 25(1)
[Inst. Zoophysiol., Univ. Innsbruck, Austria] The cellulolytic activity of the contents of the intestinal tract of populations of roach and rudd in four Tyrolean lakes was studied. Much of the activity was taken up with the diet. In fish feeding on plants and detritus a lower cellulolytic activity was found than in fish feeding on zooplankton or on arthropods. A seasonal pattern of cellulolytic activity was demonstrated with a peak in the autumn. It is assumed that the cellulolytic activity found in the intestinal contents of cyprinids is insufficient for the digestion of fibre, but that it suffices--particularly in omnivorous species--to support the breakdown of cell walls.

80-000247 Nishi, K.; Takano, K. [EFFECTS OF PHOTOPERIOD AND TEMPERATURE ON THE OVARY OF THE BITTERLING, /RHODEUS OCELLATUS OCELLATUS/.] Bull. Fac. Fish. Hokkaido Univ. 30 (1): 63-73. Feb. 1979. In Japanese with English summ. SFA 25(1)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Kaokodate, Japan]

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[Dep. Physiol., Teikyo Univ., Sch. Med., 2-11-1, Kaga, Itabashi-Ku, Tokyo 173, Japan]

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[Fish. Lab., Fac. Agric., Nagoya Univ., Nagoya 464, Chikusaku, Japan]

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[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-000252 Olcese, J. M.; Hall, T. R.; Figueroa, H. R.; de Vlaming, V. L. HYPOTHALAMIC MONOAMINE OXIDASE, A COMPONENT IN THE SEROTONERGIC CONTROL OF PITUITARY PROLACTIN CONTENT IN /CARASSIUS AURATUS/ L. Gen. Comp. Endocrinol. 38 (3): 309-313. July 1979. SFA 25(1)
[V. L. de Vlaming: Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

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[Lab. Physiol., Inst. Oceanogr., 195 rue Saint-Jacques, F 75005 Paris, France]

80-000254 O'Neill, J. G. THE IMMUNE RESPONSE OF THE BROWN TROUT, /SALMO TRUTTA/, L. TO MS2 BACTERIOPHAGE: IMMUNOGEN CONCENTRATION AND ADJUVANTS. J. Fish Biol. 15 (2): 237-248. Aug. 1979. SFA 25(1)
[Dep. Life Sci., Trent Polytech., Burton St., Nottingham NG1 4BU, England] The humoral antibody response to single intraperitoneal inoculations of MS2 bacteriophage was followed in /Salmo trutta/ using a 50 percent bacteriophage neutralisation titre (SD(50)) method. Immune memory was observed with enhancement of both the time and level of antibody production, though an initial suppression was observed 7 days after secondary inoculation. Antibody titres were related to MS2 concentration, and adjuvants were found to enhance the response. An

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increased enhancement of antibody production by Freund's complete adjuvant over that of incomplete adjuvant was observed.

80-000255 Onozato, H.; Watabe, N. STUDIES ON FISH SCALE FORMATION AND RESORPTION. III. FINE STRUCTURE AND CALCIFICATION OF THE FIBRILLARY PLATES OF THE SCALES IN /CARASSIUS AURATUS/ (CYPRINIFORMES: CYPRINIDAE). Cell Tissue Res. 201 (3): 409-422. Oct. 1979. SFA 25(1)
[N. Watabe: Electron Microsc. Cent., Univ. S.C., Columbia 29208]

80-000256 Paul, D. H.; Roberts, B. L. THE SIGNIFICANCE OF CEREBELLAR FUNCTION FOR A REFLEX MOVEMENT OF THE DOGFISH. J. Comp. Physiol. A Sens. Neural Behav. Physiol. 134 (1): 69-74. 1979. SFA 25(1)
[Dep. Physiol., Univ. Manchester, Plymouth PL1 2PB, England]

80-000257 Penney, R. K.; Goldspink, G. COMPENSATION LIMITS OF FISH MUSCLE MYOFIBRILLAR ATPASE ENZYME TO ENVIRONMENTAL TEMPERATURE. J. Therm. Biol. 4 (4): 269-272. Oct. 1979. SFA 25(1)
[Dep. Zool., Univ. Hull, Hull HU6 7RX, England] Goldfish acclimated to a range of temperatures between 5 and 35°C were found to only compensate the specific activity of their myofibrillar ATPase enzyme between 10 and 30°C. The preferred temperatures of goldfish acclimated to 5°C and to 30°C were determined to be about 10 and 26°C respectively. It is concluded that goldfish are only able to acclimate their myofibrillar ATPase system to temperatures between 10 and 30°C, but acclimation to these temperatures enables them to tolerate extremes.

80-000258 Perrier, H.; Perrier, C. SENSIVITY TO HEAT OF THE FIBRINOGEN OF THE RAINBOW TROUT (/SALMO GAIRDNERII/). Comp. Biochem. Physiol. A Comp. Physiol. 63 (4): 481-482. 1979. SFA 25(1)
[Dep. Pharmaceut. Biochem., Univ. Claude Bernard, 8 Rockefeller Ave., 69373 Lyon Cedex 2, France] Rainbow trout Accimated for 3 weeks at 9°C and 21°C during winter have an identical fibrinogen level. Experiments conducted during spring show that fibrinogen is notably lower at 21°C than at 9°C. The critical temperature which causes disappearance of fibrinogen on plasma protein disc electrophoresis pattern after /in vitro/ heating during 10 min., is 54°C for man, 52°C for carp and varies from 45°C (in winter) to 43°C (in spring) for rainbow trout.

80-000259 Pfeffer, E. UEBER DIE VERTEILUNG VON MINERALISCHEN MENGENELEMENTEN IM KOERPER VON FORELLEN UND KARPFEN. [DISTRIBUTION OF MAJOR MINERAL ELEMENTS IN THE BODY OF TROUT AND CARP.] J. Anim. Physiol. Anim. Nutr. 40 (3): 159-164. June 1978. In German with English summ. SFA 25(1)
[Inst. Tierphysiol. Tierernahrung, Univ. Gottingen, West Germany]

80-000260 Phillips, G. R.; Gregory, R. W. ASSIMILATION EFFICIENCY OF DIETARY METHYLMERCURY BY NORTHERN PIKE (/ESOX LUCIUS/). J. Fish. Res. Board Can. 36 (12): 1516-1519. Dec. 1979. In English with French summ. SFA 25(1)
[Coop. Fish. Res. Unit, Dep. Biol., Montana State Univ., Bozeman 59717]

80-000261 Primor, N.; Tu, A. T. CONFORMATION OF THE PARDAXIN, THE PURIFIED POLYPEPTIDE FROM THE TOXIC SECRETION OF THE FLATFISH, /PARDACHIRUS MARMORATUS/, USING THE RAMAN AND C. D. SPECTROMETRY. Toxicon 17 (suppl. 1): 143. 1979. Abstract only. SFA 25(1)
[Dep. Biochem., Colo. State Univ., Fort Collins 80523]

80-000262 Push, S.; Moller, P. SPATIAL ASPECTS OF ELECTROLOCATION IN THE MORMYRID FISH, /GNATHONEMUS PETERSII/. J. Physiol. (Paris) 75: 355-357. 1979. SFA 25(1)
[Dep. Ecol. Evol., State Univ. N.Y., Stoney Brook 11790]

80-000263 Rajagopal, P. K. THE EMBRYONIC DEVELOPMENT AND THE THERMAL EFFECTS ON THE DEVELOPMENT OF THE MOUNTAIN WHITEFISH, /PROSOPIUM WILLIAMSONI/ (GIRARD). J. Fish Biol. 15 (2): 153-158. Aug. 1979. SFA 25(1)
[Utah Coop. Fish. Res. Unit, UMC-52, Utah State Univ., Logan 84322]
The general development of the mountain whitefish was similar to other whitefishes. Mountain whitefish required more thermal units to reach corresponding stages of the lake whitefish, after the stage when the blastodisc was prominently raised on the yolk. The development process was greatly disrupted and a heavy mortality of eggs occurred when the temperature was raised to 9° C or higher. In hatched larvae abnormalities like monomicrophthalmia, agape jaws, and coloboma occurred when the temperature was raised to 9° C or higher, although the reported optimum temperature for growth of the post yolk sac larvae and juveniles was 9° C-12° C. The late spawned eggs exhibit adaptive mechanisms which enabled them to shorten the incubation time and hatch along with the early spawned eggs, when conditions for survival are at optimum.

80-000264 Reckhaus, W.; Romer, H.; Rahmann, H. EFFECT OF COOLING ON PHOTIC EVOKED RESPONSES IN THE OPTIC TECTUM OF TELEOSTS. J. Therm. Biol. 4 (3): 209-212. July 1979. SFA 25(1)
[Zool. Inst., Univ. Stuttgart-Hohenheim, 7000 Stuttgart 70, Hohenheim, West Germany]

80-000265 Rombout, J. H. W. M.; Rademakers, L. H. P. M.; van Hees, J. P. PANCREATIC ENDOCRINE CELLS OF /BARBUS CONCHONIUS/ (TELEOSTEI, CYPRINIDAE), AND THEIR RELATION TO THE ENTEROENDOCRINE CELLS. Cell Tissue Res. 203 (1): 9-23. Nov. 1979. SFA 25(1)
[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Marijkeweg 40, 6709 PG Wageningen, The Netherlands]

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[Inst. Dev. Biol., Acad. Sci. USSR, Moscow, USSR]

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[Dep. Physiol. Biophys., Washington Univ. Sch. Med., St. Louis, MO]

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[J. W. Goethe Univ., Fachbereich Biol. (Zool.), Siesmayerstr. 70, P 60000 Frankfort, West Germany]

80-000269 Schonborner, A. A.; Boivin, G.; Baud, C. A. THE MINERALIZATION PROCESSES IN TELEOST FISH SCALES. Cell Tissue Res. 202 (2): 203-212. Nov. 1979. SFA 25(1)
[Inst. Morphol., Ecole Med., Geneva, Switzerland]

80-000270 Shaffi, S. A. BIOCHEMICAL COMPARTMENTATION OF FISH TISSUES. II. NONSPECIFIC PHOSPHOMONOESTERASES IN BRAIN. Experientia (Basel) 35 (10): 1280-1282. 15 Oct. 1979. SFA 25(1)
[Reg. Coll. Educ., N.C.E.R.T., Shyamla Hills, Dep. Sci., Bhopal-462013 (M.P.) India]

80-000271 Shears, M. A.; Fletcher, G. L. THE BINDING OF ZINC TO THE SOLUBLE PROTEINS OF INTESTINAL MUCOSA IN WINTER FLOUNDER (/PSEUDOPLEURONECTES AMERICANUS/). Comp. Biochem. Physiol. B Comp. Biochem. 64 (3): 297-299. 1979. SFA 25(1)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-000272 Shecherbina, M. A.; Mukoseyeva, Z. A. GLYCONEOGENEIS AS A SOURCE OF ENERGY SUPPLY IN THE CARP, /CYRPINUS CARPIO/, DURING THE PERIOD OF WINTER STARVATION. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 509-513. 1978. SFA 25(1)
[All-Union Pond Fish. Res. Inst, Rybnoye Settlement, Moscow Region, USSR]

80-000273 Short, S.; Taylor, E. W.; Butler, P. J. THE EFFECTIVENESS OF OXYGEN TRANSFER DURING NORMOXIA AND HYPOXIA IN THE DOGFISH (/SCYLIORHINUS CANICULA/ L.) BEFORE AND AFTER CARDIAC VAGOTOMY. J. Comp. Physiol. B Biochem. Syst. Environ. Physiol. 132 (4): 289-295. 1979. SFA 25(1)
[Dep. Zool. Comp. Physiol., Univ. Birmingham, Birmingham B15 2TT, England]

80-000274 Stacey, N. E.; Cook, A. F.; Peter, R. E. SPONTANEOUS AND GONADOTROPIN-INDUCED OVULATION IN THE GOLDFISH, /CARASSIUS AURATUS/ L: EFFECTS OF EXTERNAL FACTORS. J. Fish Biol. 15 (3): 349-361. Sept. 1979. SFA 25(1)
[Zool. Dep., Univ. Alberta, Edmonton, AB, Canada] Spontaneous ovulation in goldfish is synchronized with photoperiod and influenced by water temperature and aquatic vegetation. As the latency to ovulation from injection of HCG is highly temperature dependent, the finding that ovulation occurs at approximately the same time of day at temperatures from 12° to 26°C suggests the time of the endogenous preovulatory gonadotropin surge may change with the temperature. The time of spontaneous ovulation adjusts to a reversed light:dark cycle within 2 weeks; some 4-6 h shifts in a single light:dark cycle modify the time of ovulation. Few sexually mature females kept under long photoperiod (16L:8D) and transferred from cold (13 ± 1°C) to warm (21 ± 1°C) water ovulated spontaneously. Exposure to artificial aquatic vegetation for as little as one light phase significantly increases the proportion of fish ovulating in warm water. Fish kept in cold water without vegetation do not ovulate; the addition of vegetation induces ovulation, although the response latency is longer than in warm water. Aquatic vegetation may be an effective stimulus for ovulation in other teleosts which spawn on this substrate.

80-000275 Stegeman, J. J. TEMPERATURE INFLUENCE ON BASAL ACTIVITY AND INDUCTION OF MIXED FUNCTION OXYGENASE ACTIVITY IN /FUNDULUS HETEROCLITUS/. J. Fish. Res. Board Can. 36 (11): 1400-1405. Nov. 1979. In English with French summ. SFA 25(1)
[Dep. Biol., Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

80-000276 Storozhuk, A. Ya. AGE-RELATED FEATURES OF THE METABOLISM OF THE COALFISH, /POLLACHIUS VIRENS/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 655-665. 1978. SFA 25(1)
[VNIRO, Moscow, USSR] It is shown that features of age-related changes in the relative weight of the liver and in other biological indicators of the coalfish, /Pollachius virens/, are to a considerable extent determined by the specifics of the physiological state during the annual cycle. The sharpest changes in the physiological-biochemical state of fish are observed during the overwintering and spawning periods. Signs of ageing of the organism are noted in specimens aged 11 years and more.

80-000277 Szabo, T.; Enger, P. S.; Libouban, S. ELECTROSENSORY SYSTEMS IN THE MORMYRID FISH, /GNATHONEMUS PETERSII/: SPECIAL EMPHASIS ON THE FAST CONDUCTING PATHWAY. J. Physiol. (Paris) 75: 409-420. 1979. SFA 25(1)
[Lab. Physiol. Nerv., Dep. Neurophysiol. Sens., CNRS, F-91190 Gif-sur-Yvette, France]

80-000278 Takashima, Y.; Takano, K.; Hara, A. [CHANGES IN FEMALE-SPECIFIC SERUM PROTEINS DURING THE COURSE OF INDUCED MATURATION OF FEMALE JAPANESE EELS (/ANGUILLA JAPONICA/).] Bull. Fac. Fish. Hokkaido Univ. 30 (1): 50-61. Feb. 1979. In Japanese with English summ. SFA 25(1)
[Lab. Fresh-Water Fish-Cult., Fac. Fish, Hokkaido Univ., Hakodate, Japan]

80-000279 Takei, Y.; Hirano, T.; Kobayashi, H. ANGIOTENSIN AND WATER INTAKE IN THE JAPANESE EEL, /ANGUILLA JAPONICA/. Gen. Comp. Endocrinol. 38 (4): 466-475. Aug. 1979. SFA 25(1)
[Dep. Physiol., Sch. Med., Kitasato Univ., Asamizodai 1, Sagamihara, Kanagawa, 228 Japan]

80-000280 Temple, N. J.; Martin, P. A.; Connock, M. J. INTESTINAL PEROXISOMES OF GOLDFISH (/CARASSIUS AURATUS/)--EXAMINATION FOR HYDROLASE, DEHYDROGENASE AND CARNITINE ACETYLTRANSFERASE ACTIVITIES. Comp. Biochem. Physiol. B Comp. Biochem. 64 (1): 57-63. 1979. SFA 25(1)
[Dep. Biol. Sci., The Polytechnic, Wolverhampton, WV1 1LY, England]

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[Dep. Biochem., Univ. Victoria, Victoria, BC V8W 2Y2, Canada]

80-000282 Ungell, A.-L.; Nilsson, S. METABOLIC DEGRADATION OF [^{3}H]-ADRENALINE IN THE ATLANTIC COD, /GADUS MORHUA/. Comp. Biochem. Physiol. C Comp. Pharmacol. 64 (1): 137-141. 1979. SFA 25(1)
[Dep. Zoophysiol., Univ. Goteborg, Fack, S-400 33 Goteborg, Sweden]

80-000283 Viancour, T. A. PERIPHERAL ELECTROSENSE PHYSIOLOGY: A REVIEW OF RECENT FINDINGS. J. Physiol. (Paris) 75: 321-333. 1979. SFA 25(1)
[Dep. Biol., Rice Univ., Houston, TX 77001]

80-000284 Vigna, S. R.; Gorbman, A. STIMULATION OF INTESTINAL LIPASE SECRETION BY PORCINE CHOLECYSTOKININ IN THE HAGFISH, /EPTATRETUS STOUTI/. Gen. Comp. Endocrinol. 38 (3): 356-359. July 1979. SFA 25(1)
[Dep. Biol., Univ. Oreg., Eugene 97405]

80-000285 Vinnikov, Ya. A.; Pyatkina, G. A.; Shakhmatova, E. I.; Natochin, Yu. V. STRUCTURE AND IONIC COMPOSITION OF OLFACTORY AND RESPIRATORY MUCUS OF STURGEONS AND THE OXIDATIVE HYPOTHESIS OF OLFACTION. Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR Ser. Biol.) 245: 837-840. Sept. 1979. SFA 25(1)
[I. M. Sechenov Inst. Evol. Physiol. Biochem., Acad. Sci. USSR, Leningrad, USSR]

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[Lab. Vergelijkende Fysiol., Rijksuniv. Utrecht, Jan van Galenstraat 40, 3572 LA Utrecht, The Netherlands]

80-000287 Warner, M. C.; Tomb, A. M.; Diehl, S. A. VARIABILITY AND STABILITY OF SELECTED COMPONENTS IN RAINBOW TROUT /SALMO GAIRDNERI/ SERUM AND THE PRECISION OF AUTOMATED ANALYSIS IN MEARSURING THESE COMPONENTS. J. Fish Biol. 15 (2): 141-151. Aug. 1979. SFA 25(1)
[Alaska Dep. Fish Game, Subport Bldg., Juneau 99801]

80-000288 Wasserman, G. S.; Johnston, R. M. POISONING FROM A LIONFISH STING. Vet. Human Toxicol. 21 (5): 344-345. Oct. 1979. SFA 25(1)
[Children's Mercy Hosp., Univ. Mo., Sch. Med., Kansas City]

80-000289 Winstead, J. T. A SIMPLE METHOD TO OBTAIN SERUM FROM SMALL FISH. NOAA Fish. Bull. 77 (2): 509-511. Apr. 1979. SFA 25(1)
[U.S. EPA, Sabine Island Lab., Gulf Breeze, FL 32561]

80-000290 Wood, M. R.; Cohen, M. J. SYNAPTIC REGENERATION IN IDENTIFIED NEURONS OF THE LAMPREY SPINAL CORD. Science 206 (4416): 344-347. 19 Oct. 1979. SFA 25(1)
[Dep. Biol., Yale Univ., New Haven, CT 06520]

80-000291 Zelson, P. R.; Cagan, R. H. BIOCHEMICAL STUDIES OF TASTE SENSATION--VIII. PARTIAL CHARACTERIZATION OF ALANINE-BINDING TASTE RECEPTOR SITES OF CATFISH /ICTALURUS PUNCTATUS/ USING MERCURIALS, SULFHYDRYL REAGENTS, TRYPSIN AND PHOSPHOLIPASE C. Comp. Biochem. Physiol. B Comp. Biochem. 64 (2): 141-147. 1979. SFA 25(1)
[R. H. Cagan: Monell Chem. Sens. Cent., Univ. Pa., 3500 Market St., Philadelphia 19104] Taste receptors for L-alanine in the channel catfish /Ictalurus punctatus/ have been partially characterized. The binding activity, which is localized to a sedimentable fraction (Fraction P2), was assayed with L-[^{3}H]alanine as the ligand. Addition of HgCl(2) or /p/-mercuribenzoate to the assay at 0.1-1mM markedly inhibited binding. The effect was not reversible and was unaffected by increased l-alanine in the binding assay. The sulfhydryl reagents iodoacetate, 5,5'-dithiobis(2-nitrobenzoic acid), arsenite, and N-ethylmaleimide did not show appreciable inhibition of binding. The results suggest that the inhibitory effect of mercurials is not on specific sulfhydryl groups at alanine-binding sites. Treatment of Fraction P2 with phospholipase C decreased binding activity and treatment with trypsin led to increased binding activity.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-000292 Arai, K.; Onozato, H.; Yamazaki, F. ARTIFICIAL ANDROGENESIS INDUCED WITH GAMMA IRRADIATION IN MASU SALMON, /ONCORHYNCHUS MASOU/. Bull. Fac. Fish. Hokkaido Univ. 30 (3): 181-186. Aug. 1979. SFA 25(1)
[Lab. Embryol. Genet., Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-000293 Arai, K.; Yamazaki, F. DEVELOPMENTAL CHANGES OF LACTATE DEHYDROGENASE (LDH) ISOZYMES IN THE HYBRID BETWEEN MASU SALMON (/ONCORHYNCHUS MASOU/) AND PINK SALMON (/O. GORBUSCHA/). Bull. Fac. Fish. Hokkaido Univ. 30 (2): 124-128. May 1979. SFA 25(1)
[Lab. Embryol. Genet., Fac. Fish., Hokkaido Univ., Hoakodate, Japan]

80-000294 Ayles, G. B.; Bernard, D.; Hendzel, M. GENETIC DIFFERENCES IN LIPID AND DRY MATTER CONTENT BETWEEN STRAINS OF RAINBOW TROUT (/SALMO GAIRDNERI/) AND THEIR HYBRIDS. Aquaculture 18 (3): 253-262. Nov. 1979. SFA 25(1)
[Fish. Oceans. Can., West. Reg., Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada] Observed phenotypic differences of lipid content between strains of rainbow trout and their hybrids cultured in small Canadian prairie lakes are related to differences in the size of fish and highly correlated with differences in growth rate. As a percent of dry matter mean lipid levels of different strains and their hybrids ranged from 32.5 percent to 45.9 percent in one experiment and from 11.6 percent to 24.3 percent in another. There were significant additive genetic differences in lipid content between strains, independent of differences in weight, and there also appeared to be significant non-additive x environment interactions. Phenotypic differences in percent dry matter were small compared to the differences in lipid content.

80-000295 Bodaly, R. A. MORPHOLOGICAL AND ECOLOGICAL DIVERGENCE WITHIN THE LAKE WHITEFISH (/COREGONUS CLUPEAFORMIS/) SPECIES COMPLEX IN YUKON TERRITORY. J. Fish. Res. Board Can. 36 (10): 1214-1222. Oct. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

80-000296 Danzmann, R. G. THE KARYOLOGY OF EIGHT SPECIES OF FISH BELONGING TO THE FAMILY PERCIDAE. Can. J. Zool. 57 (10): 2055-2060. Oct. 1979. In English with French summ. SFA 25(1)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Four species of fish from the genus /Etheostoma/, two species from the genus /Percina/, the yellow perch (/Perca flavescens/), and the walleye (/Stizostedion v. vitreum/), from the family Percidae, were examined karyotypically. All species had a diploid number of 48 chromosomes. Similarity in the karyotype of the yellow perch and walleye suggests a monophyletic origin for the subfamilies Percinae and Luciopercinae. Evolution in the family involved pericentric inversions and (or) translocations of chromosomes giving rise to metacentric and submetacentric chromosomes in the genera /Percina/ and /Etheostoma/. /Etheostoma exile/, /E. flabellare/, and /E. caeruleum/ all show a marked reduction in the size of the smallest pair of homologues (group C). The last two pairs of homologues in /E. nigrum/ are of uniform size.

80-000297 Dobrovolov, I. POLYMORPHISM OF MUSCLE PROTEINS OF THE ANCHOVY, /ENGRAULIS ENCRASICHOLUS/, OF THE AZOV-BLACK SEA BASIN AND THE ATLANTIC OCEAN. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 483-489. 1978. SFA 25(1)
[Fish Resour. Inst., Varna, Bulgaria]

80-000298 Dyatlov, M. A. POPULATION HETEROGENEITY OF THE CISCO, /COREGONUS ALBULA/, OF LAKE LADOGA. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 536-544. 1978. SFA 25(1)
[Sev NIORKh, Petrozavadsk, USSR]

80-000299 Edwards, R. J. A REPORT OF GUADALUPE BASS (/MICROPTERUS TRECULI/) X SMALLMOUTH BASS (/M. DOLOMIEUI/) HYBRIDS FROM TWO LOCALITIES IN THE GUADALUPE RIVER, TEXAS. Tex. J. Sci. 31 (3): 231-238. Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Tex., Austin 78712] Due to a variety of reasons, natural /Micropterus/ interspecific hybrids have rarely been found. Two instances of native /M. treculi/ x exotic /M. dolomieui/ hybridization are reported from the Guadalupe R. system, Comal Co., Texas. Apparently, environmental perturbations in the study localities and the introduction of a non-native species have contributed to the production of these hybrids, creating additional threats to the genetic integrity and continued survival of /M. treculi/, a central Texas endemic.

80-000300 Gall, G. A. E. TWO-STAGE TROUT BROODSTOCK SELECTION PROGRAM: REPRODUCTIVE PERFORMANCE AND GROWTH RATE. Calif. Dep. Fish Game Inland Fish. Admin. Rep. No. 79-2. 24p. Oct. 1977. SFA 25(1)
[Dep. Anim. Sci., Univ. Calif., Davis] The trout broodstocks maintained by the Department are descendants of wild trout trapped and artificially spawned many years ago. These include rainbow, brook, and brown trout used for fishery enhancement and recreation. Although significant gains have been achieved in the past, future improvements under conditions of escalating costs and contracting resources will depend on the development and utilization of efficient mating systems and a scientifically designed selection program. The objective of the program is to supply, through genetic means, quality brood fish that will provide large numbers of high performing fingerlings which will result in improved economics of production of catchable-sized fish. The program is limited to the following four traits plus time of spawning: size of eggs, number of eggs, hatchability, and yearling size of the fish. Selection is performed in two stages. In the first stage, the net merit of individual mating pairs is determined by a selection index of female performance for size and number of eggs and an independent culling level to assess hatchability performance of the pair. In the second stage, mass selection is practiced for yearling weight measured as the weight of individual fish. Reproductive value is evaluated on the basis of both individual performance and the average performance of full-sisters of both the dam and sire. Detailed information regarding data collection procedures, scoring of performance, and marking of fish are included in this report. The FORTRAN computer program is available from the author.

80-000301 Hopkins, K. D. PRODUCTION OF MONOSEX TILAPIA FRY BY BREEDING SEX-REVERSED FISH. Ph.D. dissertation, Auburn Univ. 44p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5):1971. Nov. 1979. SFA 25(1)

80-000302 Kincaid, H. L. DEVELOPMENT OF STANDARD REFERENCE LINES OF RAINBOW TROUT. Trans. Am. Fish. Soc. 108 (5): 457-461. Sept. 1979. SFA 25(1)
[U.S. FWS, Fish Genet. Lab., P.O. Box 278, Beulah, WY 82712]

80-000303 Klupp, R. GENETIC VARIANCE FOR GROWTH IN RAINBOW TROUT (/SALMO GAIRDNERI/). Aquaculture 18 (2): 123-134. Oct. 1979. SFA 25(1)
[Lehrstuhl Tierzuch. Tech. Univ. Munchen, D-8050 Freising-Werhenstephan, West Germany] The possibilities of genetic improvement of growth of rainbow trout were investigated. Two half-diallel crossing experiments with three strains were performed. In the second experiment families within a strain or strain combinations could be identified. One hundred fish of each strain, strain cross or family were measured at five or four different ages. Differences between strains, crosses and between families within each of them were highly significant at all ages. In juvenile stages heterosis seemed to be present, although it was not statistically significant. Differences between strains became more pronounced as age advanced. Genetic variance within strains and strain crosses was large and appeared to increase with age. Genetic improvement by selection appears promising provided mass selection is not performed too early. The small F-values of preliminary expt. 2 may indicate strong competition within each group which tends to increase residual variability.

80-000304 Laarman, P. W. REPRODUCTION OF F(1) HYBRID SUNFISHES IN SMALL PONDS. Prog. Fish-Cult. 41 (3): 145-147. July 1979. SFA 25(1)
[Mich. Dep. Nat. Resour., Inst. Fish. Res., Ann Arbor 48109]

80-000305 Loudenslager, E. J.; Kitchin, R. M. GENETIC SIMILARITY OF TWO FORMS OF CUTTHROAT TROUT, /SALMO CLARKI/, IN WYOMING. Copeia 1979 (4): 673-678. 28 Nov. 1979. SFA 25(1)
[Dep. Anim. Sci., Univ. Calif., Davis 95616] Patterns of genetic differentiation among populations of cutthroat trout, /Salmo clarki/, in fluvial and lacustrine habitats, as well as in an area where suspected subspecies occur sympatrically were studied using protein electrophoresis. Genetic variability is very low for two genetic parameters; the proportion of loci heterozygous per individual averaged 0.01, and the proportion of loci polymorphic per population averaged 0.05. These low values are attributed to the influence of recent glaciations. The genetic identity of populations is within a narrow spectrum of 1.00 to 0.995. An estimation of the time since divergence between the two morphological forms of cutthroat trout, based on the electrophoretic identity of proteins, is 20,000 years. These results support a hypothesis of a recent origin of the fine-spotted cutthroat trout within the Snake River drainage.

80-000306 May, B.; Stoneking, M.; Wright, J. E., Jr. JOINT SEGREGATION OF MALATE DEHYDROGENASE AND DIAPHORASE LOCI IN BROWN TROUT (/SALMO TRUTTA/). Trans. Am. Fish. Soc. 108 (4): 373-377. July 1979. SFA 25(1)
[Dep. Biol., Pa. State Univ., University Park 16802]

80-000307 May, B.; Wright, J. E.; Stoneking, M. JOINT SEGREGATION OF BIOCHEMICAL LOCI IN SALMONIDAE: RESULTS FROM EXPERIMENTS WITH /SALVELINUS/ AND REVIEW OF THE LITERATURE ON OTHER SPECIES. J. Fish. Res. Board Can. 36 (9): 1114-1128. Sept. 1979. In English with French summ. SFA 25(1)
[Dep. Biol., Pa. State Univ., University Park 16802]

80-000308 McGlade, J.; MacCrimmon, H. TAXONOMIC CONGRUENCE IN THREE POPULATIONS OF QUEBEC BROOK TROUT, /SALVELINUS FONTINALIS/ (MITCHILL). Can. J. Zool. 57 (10): 1998-2009. Oct. 1979. In English with French summ. SFA 25(1)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-000309 Mrakovcic, M.; Haley, L. E. INBREEDING DEPRESSION IN THE ZEBRA FISH /BRACHYDANIO RERIO/ (HAMILTON BUCHANAN). J. Fish Biol. 15 (3): 323-327. Sept. 1979. SFA 25(1)
[Univ. Zagreb, Mikuliceva 32, Yugoslavia] Inbreeding depression was observed in Half and Full sib matings (Inbreeding Coefficient 0.125 and 0.25) of Zebra Danios (/Brachydanio rerio/). Inbreeding at these levels reduced fertility, survival to 30 days, and length at 30 days. There was an increase in the incidence of crippled fry. No effect of inbreeding on either number of eggs per spawn or hatchability were found.

80-000310 Murofushi, M.; Yosida, T. H. CYTOGENETICAL STUDIES ON FISHES, II. KARYOTYPES OF FOUR CARANGID FISHES. Jpn. J. Genet. 54 (5): 367-370. Oct. 1979. SFA 25(1)
[Lab. Biol., Mishima Junior Coll,. Nihon Univ., Mishima 411, Japan]

80-000311 Pontier, P. J.; Hart, N. H. CREATINE KINASE GENE EXPRESSION DURING THE DEVELOPMENT OF /BRACHYDANIO/. J. Exp. Zool. 209 (2): 283-296. Aug. 1979. SFA 25(1)
[Dep. Med., Univ. Tex. Med. Sch., Houston 77025]

80-000312 Russell, H. A.; Jeffrey, J. H. SERUM TRANSFERRIN POLYMORPHISM IN GREY TROUT, /CYNOSCION REGALIS/, FROM THE LOWER RAPPAHANNOCK RIVER. Estuaries 2 (4): 269-270. Dec. 1979. SFA 25(1)
[Dep. Biol., Va. Commonwealth Univ., 901 W. Franklin St., Richmond, VA 23284] Serum transferrin distribution was studied in grey trout, /Cynoscion regalis/, obtained from the lower Rappahannock River of Virginia. Three phenotypes were observed, representing two codominant alleles at a single gene locus. The distribution of the phenotypes, designated as Tf A, Tf B, and Tf AB, did not differ significanly from that predicted by Hardy-Weinberg analysis.

80-000313 Ryabov, I. N. FEATURES OF THE EMBRYONIC AND LARVAL DEVELOPMENT OF THE HYBRID OF THE CARP, /CYPRINUS CARPIO/, AND THE "FIERY /PUNTIUS/", /PUNTIUS CONCHONIUS/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 577-588. 1978. SFA 25(1)
[Zool. Mus., Moscow Univ., USSR]

80-000314 Tave, D. L. HERITABILITY ESTIMATES FOR LENGTH AND WEIGHT AT 45 AND 90 DAYS IN /TILAPIA NILOTICA/, AND THE CORRELATIONS BETWEEN THESE TRAITS. Ph.D. dissertation, Auburn Univ. 41p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(3):1000. Sept. 1979. SFA 25(1)

80-000315 Thompson, K. W. CYTOTAXONOMY OF 41 SPECIES OF NEOTROPICAL CICHLIDAE. Copeia 1979 (4): 679-691. 28 Nov. 1979. SFA 25(1)
[Cent. Environ. Stud., VPI&SU, Blacksburg, VA 24061]

BEHAVIOR

80-000316 Bachman, R. A.; Reynolds, W. W.; Casterlin, M. E. DIEL LOCOMOTOR ACTIVITY PATTERNS OF WILD BROWN TROUT (/SALMO TRUTTA/ L.) IN AN ELECTRONIC SHUTTLEBOX. Hydrobiologia 66 (1): 45-47. 15 Sept. 1979. SFA 25(1)
[Dep. Biol., Pa. State Univ., University Park 16802] As part of a study to quantify use of space and time by wild brown trout (/Salmo trutta/ L.), we tested 12 trout (in four groups of three; four separate experiments lasting 8 days each; 96 total fish-days of data) in an electronic shuttlebox (ichthyotron) under natural winter temperature and photoperiod conditions, to determine their diel patterns of locomotor activity. Activity was quantified as the number of photocell-monitored light-beam interruptions per hour as fish passed between chambers of the shuttlebox. Data from all four experiments, pooled and expressed as hourly percentages of 24-hour diel activity, yielded a bimodal (crepuscular) pattern, with a major peak at dawn and a lesser one around dusk. The fish were not fed during the experiments, so feeding schedules had no effect on these results. Another experiment with a single fish yielded results similar to the three-fish groups. Other experiments failed to demonstrate a free-running circadian rhythm in this species under constant darkness (DD), and this, along with an apparent lack of anticipation of light change in the activity pattern, suggests that the diel activity pattern observed in this species is exogenously controlled by either absolute light intensity or changing light intensity, or both. Field studies are underway to determine whether diel activity patterns of wild brown trout are the same under natural conditions.

80-000317 Blake, R. W. THE MECHANICS OF LABRIFORM LOCOMOTION. I. LABRIFORM LOCOMOTION IN THE ANGELFISH (/PTEROPHYLLUM EIMEKEI/): AN ANALYSIS OF THE POWER STROKE. J. Exp. Biol. 82: 255-271. Oct. 1979. SFA 25(1)
[Dep. Zool., Univ. Cambridge, England]

80-000318 Buwalda, R. J. A.; van der Steen, J. THE SENSITIVITY OF THE COD SACCULUS TO DIRECTIONAL AND NON-DIRECTIONAL SOUND STIMULI. Comp. Biochem. Physiol. A Comp. Physiol. 64 (4): 467-471. 1979. SFA 25(1)
[Lab. Comp. Physiol., State Univ. Utrecht, 40 Jan van Galenstraat, Utrecht, The Netherlands] Saccular microphonic responses to underwater sound stimuli were recorded in cod (/Gadus morhua/ L.). Stimuli with p (pressure) to v (velocity) ratios of -50 to +10 dB re far field value were produced by standing wave manipulation. In "high v" conditions a cosine dependence of microphonic levels upon sound direction was found, compatible with a vector detector function for left and right sacculus. "High p" abolished this directional sensitivity. At 122 Hz and p/v ratios of ca - 12 dB, p and v were

80-000318 CONTINUED
equally effective, resulting in a microphonic null response at a phase lead of v by 90°.

80-000319 Casterlin, M. E.; Reynolds, W. W. AGONISTIC DISPLAYS IN THE ROCK BASS, /AMBLOPLITES RUPESTRIS/. Hydrobiologia 65 (1): 19-21. 16 July 1979. SFA 25(1)
[Dep. Biol., Pa. State Univ., Wilkes-Barre 18708] Agonistic encounters between pairs of adult rock bass, /Ambloplites rupestris/ were observed and the behaviour and changes in coloration of the dominant and subordinated individuals analysed. Dominance coloration involved the establishment of a high degree of visual contrast, whereas subordinate coloration made the animals darker and their coloration less striking, thus perhaps serving a protective function.

80-000320 Casterlin, M. E.; Reynolds, W. W. SHARK THERMOREGULATION. Comp. Biochem. Physiol. A Comp. Physiol. 64 (3): 451-453. 1979. SFA 25(1)
[Biol. Dep., Pa. State Univ., POB 1830, Wilkes-Barre 18708] Smooth dogfish sharks, /Mustelus canis/, thermoregulating behaviorally in an electronic shuttlebox preferred a mean temperature of 27.1°C, with a mid-day peak of 28.0°C and crepuscular minima of 25.9°C (dawn) and 26.4°C (dusk). These sharks thermoregulated with the same degree of precision shown by bony fishes. such precise thermoregulation has not previously been reported for any elasmobranch species.

80-000321 Dorn, P.; Johnson, L.; Darby, C. THE SWIMMING PERFORMANCE OF NINE SPECIES OF COMMON CALIFORNIA INSHORE FISHES. Trans. Am. Fish. Soc. 108 (4): 366-372. July 1979. SFA 25(1)
[Res. Dev. Dep., South. Calif. Edison Co., Rosemead, CA 91770]

80-000322 Finger, T. R. PATTERNS OF INTERACTIVE SEGREGATION IN THREE SPECIES OF SCULPINS (/COTTUS/) IN WESTERN OREGON. Ph.D. dissertation, Oreg. State Univ. 135p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5):2030. Nov. 1979. SFA 25(1)

80-000323 Guennegan, Y.; Rannou, M. SEMI-DIURNAL RHYTHMIC ACTIVITY IN DEEP-SEA BENTHIC FISHES IN THE BAY OF BISCAY. Sarsia 64 (1/2): 113-116. 1979. SFA 25(1)
[Cent. Oceanol. Bretagne, BP 337, 29273 Brest, France] A large baited trap, supporting an Edgerton flash camera system was used several times in the Bay of Biscay between 2000 and 4700 m. Colour photographic sequences (one shot every 3 minutes for about 20 hours) reveal that the presence of fishes around the trap is almost always periodic. This behaviour is synchronous with periodic changes in the direction of weak currents, as indicated by yarns hanging in the trap. Fishes appear outside the trap shortly before low tide on the shore of the Bay. One or two hours before high tide a period of about 6 hours begins with no fish around the trap. They come back a little before the next low tide. This is consistent with various recent records of semi-diurnal tidal currents in the depth of the Bay. It is the only recovered geophysical cycle in the deep-sea and it has clear consequences on the biology of fishes and other benthic animals.

80-000324 Hara, T. J.; Brown, S. B. OLFACTORY BULBAR ELECTRICAL RESPONSES OF RAINBOW TROUT (/SALMO GAIRDNERI/) EXPOSED TO MORPHOLINE DURING SMOLTIFICATION. J. Fish. Res. Board Can. 36 (10): 1186-1190. Oct. 1979. In English with French summ. SPA 25(1)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

80-000325 Hosmer, M. J.; Stanley, J. G.; Hatch, R. W. EFFECT OF HATCHERY PROCEDURES ON LATER RETURN OF ATLANTIC SALMON TO RIVERS IN MAINE. Prog. Fish-Cult. 41 (3): 115-119. July 1979. SPA 25(1)
[U.S. FWS, Experimental Hatchery, Kearneysville, WV 25430]

80-000326 Hubert, W. A. SOME PHYSICAL ELEMENTS OF ADULT SMALLMOUTH BASS HABITAT IN A TENNESSEE RIVER MAINSTREAM RESERVOIR AS DETERMINED BY ULTRASONIC TELEMETRY. Ph.D. dissertation, Va. Polytech. Inst. State Univ. 120p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5): 1978. Nov. 1979. SPA 25(1)

The nature of selected physical elements of adult smallmouth bass habitat in a large mainstream impoundment was evaluated by means of underwater ultrasonic telemetry. Seasonal water temperatures were within the range of tolerance by smallmouth bass, but late summer temperatures exceeded optimum for the species and probably reduced movement. Shallow winter distributions were believed to be a function of cover availability near the water surface, low current velocities, and cloudy skies. Moderate current velocities were associated with smallmouth bass during all seasons of the year. Fluctuations in current velocity and reservoir elevation influenced depth distribution and movement of individual fish. Operation of Wilson and Pickwick Dams for power production, flood control, and navigation and the subsequent effect on current velocity and reservoir elevation influenced the depth distribution and movement of individual smallmouth bass in Pickwick Reservoir. Bottom relief was a major variable governing distribution and movement patterns. Dropoffs between 30° and 45° from the overbank into the original river channel or inundated creek channels were the most common forms of bottom relief utilized by the study fish. Bottom contours influenced the shape of residence areas and movement pathways outside of residence areas. Cover in the form of rocks, stumps, sunken trees, and crevices in hard clay banks was utilized by smallmouth bass. The material from which cover was formed did not appear to be important as long as the cover supplied visual orientation, shelter from current, and darkness. The distribution of cover probably influenced depth distribution, movement along bottom contours, and aggregation of smallmouth bass. Homing abilities of smallmouth bass were observed, particularly homing following voluntary Sojourns.--From abstr.

80-000327 Janzow, F. T. THE SENSORY BASIS OF SOCIAL BEHAVIOR IN THE LARGEMOUTH BASS (/MICROPTERUS SALMOIDES/). Ph.D. dissertation, Okla. State Univ. 132p. 1978. From Diss. Abstr. Int. B Sci. Eng. 40(4): 1579. Oct. 1979. SPA 25(1)

The sensory basis of species recognition and dominance hierarchy establishment in largemouth bass, /Micropterus salmoides/, was studied. Visual, olfactory and lateral line senses were selectively blocked to determine the relative importance of these sensory systems in discrimination between bluegill and bass and in the development of dominance hierarchies. Qualitative descriptions of agonistic motor patterns and color patterns were made. Results suggest a dichotomous sensory basis for species recognition and dominance encounters. Vision and the lateral line appear to be the primary senses involved in discrimination between conspecifics and heterospecifics. Vision and olfaction are necessary for the development of stable dominance

80-000327 CONTINUED
relationships. Motor patterns of bass are similar to those of other centrarchids. Bass also perform spitting, shambiting, and quivering in agonistic contexts.

80-000328 Kanamoto, Z. [ON THE ECOLOGY OF HEXAGRAMMID FISH. IV. MODE OF THE DISTRIBUTION OF /AGRAMMUS AGRAMMUS/ (TEMMINCK ET SCHLEGEL) AND /HEXAGRAMMOS OTAKII/ JORDAN ET STARKS AND COMPOSITION, ABUNDANCE AND FOOD ITEMS OF REEF FISH AROUND THE SEVERAL REEFS.] Jpn. J. Ecol. 29 (2): 171-183. June 1979. In Japanese with English summ. SFA 25(1)
[Dep. Fish. Biol., Fac. Agric., Tohoku Univ., Sendai, 980, Japan]

80-000329 Karplus, I.; Tsurnamal, M.; Szlep, R.; Algom, D. FILM ANALYSIS OF THE TACTILE COMMUNICATION BETWEEN /CRYPTOCENTRUS STEINITZI/ (PISCES, GOBIIDAE) AND /ALPHEUS PURPURILENTICULARIS/ (CRUSTACEA, ALPHEIDAE). J. Comp. Ethol. 49 (4): 337-351. Apr. 1979. In English with German summ. SFA 25(1)
[Heinz Steinitz Mar. Biol. Lab., Hebrew Univ. Jerusalem, Elat, Israel] The tactile communication between the symbiotic goby /Cryptocentrus steinitzi/ and its burrowing shrimp partner /Alpheus purpurilenticularis/ was investigated by film analysis. Warning signals of the goby which elicit the retreat of the shrimp into its burrow consist mainly of rapid fin flicks transmitted to the shrimp through its long antennae. Five different parameters of the structure of the warning signal were analyzed. The effect of various variables on the response of the shrimp and its latency were examined with a stepwise multiple regression analysis. Feedback mechanisms involved in this communication system are described. The evolution of the tail flick warning signal and a model describing the relationship between the main elements involved in the generation of warning signals are discussed.

80-000330 Kratt, L. F.; Smith, R. J. F. AGONISTIC BEHAVIOUR OF AGE 0, AGE 1 AND NON-BREEDING ADULT ARCTIC GRAYLING /THYMALLUS ARCTICUS/ (PALLAS). J. Fish Biol. 15 (4): 389-404. Oct. 1979. SFA 25(1)
[Beak Consultants Ltd., 3530 11A Street N.E., Calgary, AB T2E 6M7, Canada] Age 0 Arctic grayling begin to show agonistic behaviour 3 weeks after emergence and are territorial by their fourth week. Age 1 fish are territorial throughout the summer feeding period. In adults, territoriality is restricted to larger males during the early spring breeding season while after the breeding season both smaller adult males and adult females also hold territories. In sub-adults, larger fish and resident fish tend to win most fights. In adults, males usually win against females. In fights between adults of the same sex, larger and resident fish usually win. The lateral display becomes more important in the agonistic repertoire of Arctic grayling as they mature and the characteristic large dorsal fin develops. Arctic grayling appear to lack an appeasement display.

80-000331 Miller, R. J.; Janzow, F. T. AN EXPERIMENT ON VISUAL DISCRIMINATION IN THE LARGEMOUTH BASS, /MICROPTERUS SALMOIDES/. Proc. Okla. Acad. Sci. 59: 34-40. 1979. SFA 25(1)
[Dep. Gen. Evol. Biol., Okla. State Univ., Stillwater 74074] Eighteen largemouth bass were run through a training procedure designed to determine whether they could use visual cues (hue, opacity, fluorescence) associated with different monofilament fishing lines in solving a discrimination problem leading to a food reward (an earthworm). Each fish was fed a worm attached to one ("reward line") of two different-colored monofilament lines presented six times per day for several days, then was given an additional worm for taking a

80-000331 CONTINUED
very small piece attched to the reward line. When the feeding response to a tiny attached piece of worm was swift and unhesitating, the first test phase began: the fish was required to bite the empty snap-swivel on the reward line before it was given an allochthonous worm. When the fish bit the reward line in 5 of 6 trials (criterion) it was tested with single-strand monofilament lines (versus 3-strand braided in the first test phase) until it either reached criterion or clearly demonstrated an inability to selectively respond to the reward line. At least one fish was able to discriminate between each line combination tested (3-strand) and the majority of the fish tested were able to reach criterion in the one-strand test as well. Some line combinations proved to be more easily discriminable than others.

80-000332 Mizuno, N.; Uehara, S.; Maki, M. [STUDIES ON A FRESHWATER FISH, /RHINOBIUS BRUNNEUS/ (GOBIIDAE). IV. HABITAT SEGREGATION AMONG SYMPATRIC POPULATIONS OF 4 COLOUR TYPES.] Jpn. J. Ecol. 29 (2): 137-147. June 1979. In Japanese with English summ. SFA 25(1)
[Biol. Inst., Fac. Sci., Ehime Univ., Matsuyama, 790, Japan]

80-000333 Neproshin, A. Yu. BEHAVIOR OF THE PACIFIC MACKEREL, /PNEUMATOPHORUS JAPONICUS/, /WHEN AFFECTED BY VESSEL NOISE. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 695-699. 1978. SFA 25(1)
[TINRO, Vladivostok, USSR]

80-000334 Niwa, H. SCOTOPIC ERG AND PHOTOPIC S-POTENTIAL IN FISH--COMPARISON WITH BEHAVIOURAL DATA. Comp. Biochem. Physiol. A Comp. Physiol. 64 (4): 581-584. 1979. SFA 25(1)
[Fish. Lab., Fac. Agric., Nagaya Univ., Nagaya, Japan]

80-000335 Pals, N.; Schoenhage, A. A. C. MARINE ELECTRIC FIELDS AND FISH ORIENTATION. J. Physiol. (Paris) 75: 349-353. 1979. SFA 25(1)
[Lab. Vergelijkende Fysiol., Rijksuniv. Utrecht, Jan van Galenstraat 40, 3572 LA Utrecht, The Netherlands]

80-000336 Peeke, H. V. S.; Figler, M. H.; Blankenship, N. RETENTION AND RECOVERY OF HABITUATED TERRITORIAL AGGRESSIVE BEHAVIOR IN THE THREE-SPINED STICKLEBACK (/GASTEROSTEUS ACULEATUS/ L.): THE ROLES OF TIME AND NEST RECONSTRUCTION. Behaviour 69 (3/4): 171-182. 1979. In English with German summ. SFA 25(1)
[Lab. Psychobiol., Dep. Psychiatry, Univ. Calif., San Francisco]

80-000337 Peterson, R. H.; Sutterlin, A. M.; Metcalfe, J. L. TEMPERATURE PREFERENCE OF SEVERAL SPECIES OF /SALMO/ AND /SALVELINUS/ AND SOME OF THEIR HYBRIDS. J. Fish. Res. Board Can. 36 (9): 1137-1140. Sept. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB EOG 2XO, Canada]

80-000338 Powles, P. M. FISH OF THE KAWARTHAS, PART II. "COOL-WATER" SPECIES. Trent Univ. Biol. Dep. Ecol. Bull. 3 (2): 3-7. 1977. SFA 25(1)
[Biol. Dep., Trent Univ. Peterborough, ON K9J 7B8, Canada]

80-000339 Reynolds, W. W.; Casterlin, M. E. EFFECT OF TEMPERATURE ON LOCOMOTOR ACTIVITY IN THE GOLDFISH (/CARASSIUS AURATUS/) AND THE BLUEGILL (/LEPOMIS MACROCHIRUS/): PRESENCE OF AN 'ACTIVITY WELL' IN THE REGION OF THE FINAL PREFERENDUM. Hydrobiologia 65 (1): 3-5. 16 July 1979. SFA 25(1)
[Dep. Biol., Pa. State Univ., Wilkes-Barre 18708] Goldfish (/Carassius auratus/) and bluegill sunfish (/Lepomis macrochirus/) were placed in aquaria where their locomotor activity was monitored by photocells, and tested at various acclimation temperatures over a range encompassing their final thermal preferenda. Activity was pooled over 24-hour periods to eliminate any circadian rhythm effects. Both species exhibited an 'activity well' of reduced locomotor activity in the region of the final preferendum. Goldfish, tested either singly or in groups of 2-5 individuals, exhibited a social-interaction effect which became more pronounced at higher temperatures. These results are discussed in relation to a thermokinetic interpretation of thermoregulatory behavior in fishes, and to the correspondence between thermal preferenda and thermal optima.

80-000340 Reynolds, W. W.; Casterlin, M. E. THERMOREGULATORY RHYTHM IN JUVENILE MUSKELLUNGE (/ESOX MASQUINONGY/): EVIDENCE OF A DIEL SHIFT IN THE LOWER SET-POINT. Comp. Biochem. Physiol. A Comp. Physiol. 63 (4): 523-525. 1979. SFA 25(1)
[Dep. Biol., Pa. State Univ., Wilkes-Barre 18708] Twelve juvenile muskellunge (/Esox masquinongy/) tested individually in electronic shuttleboxes exhibited a diel rhythm of preferred temperature, with a low of 21.9°C at dawn and a maximum of 27.3°C in late afternoon. The diel pattern of locomotor activity exhibited maxima early and late in the day, when preferred temperatures were beginning to increase and to decrease, respectively; 94 percent of the 24-hr total activity occurred during the day. Comparison of nocturnal and diurnal preferred-temperature frequency distributions suggests that at night the lower thermoregulatory set-point decreases, while the upper set-point does not change; the lower set-point is higher during the day.

80-000341 Richkus, W. A.; Winn, H. E. ACTIVITY CYCLES OF ADULT AND JUVENILE ALEWIVES, /ALOSA PSEUDOHARENGUS/, RECORDED BY TWO METHODS. Trans. Am. Fish. Soc. 108 (4): 358-365. July 1979. SFA 25(1)
[Environ. Cent. Martin Marietta Corp., 1450 S. Rolling Rd., Baltimore, MD 21227]

80-000342 Robertson, D. R.; Sheldon, J. M. COMPETITIVE INTERACTIONS AND THE AVAILABILITY OF SLEEPING SITES FOR A DIURNAL CORAL REEF FISH. J. Exp. Mar. Biol. Ecol. 40 (3): 285-298. 8 Oct. 1979. SFA 25(1)
[Smithsonian Trop. Res. Inst., Box 2072, Balboa, Panama Canal Zone]

80-000343 Roed, K. H. THE TEMPERATURE PREFERENCE OF THE THREE-SPINED STICKLEBACK, /GASTEROSTEUS ACULEATUS/ L. (PISCES), COLLECTED AT DIFFERENT SEASONS. Sarsia 64 (3): 137-141. 1979. SFA 25(1)
[Inst. Mar. Biol. Limnol., Univ. Oslo, P.B. 1064 Blindern, Oslo 3, Norway] Thermal preferences were determined, at different seasons, in an aquarium with stable vertical gradients. The temperature preference was found similar for fish collected in April, June, August, and October, despite different acclimation temperatures and length of acclimation period. Both 0-group and 1-group or older fish chose temperatures less than 11°C, and in most cases preferred temperatures between 4 and 8°C, which was lower than the /in situ/ temperatures most of the year. The results suggest that the temperature preference of stickleback from Oslofjorden may be genetically determined.

80-000344 Sawa, M. AN INSTRUMENT FOR THE AUTOMATIC DETERMINATION OF AUDITORY THRESHOLDS IN SINGLE NEURONS. Bull. Fac. Fish. Hokkaido Univ. 30 (1): 14-22. Feb. 1979. SFA 25(1)
[Lab. Physiol. Ecol., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-000345 Serebrov, L. I. THE DISTRIBUTION OF THE YOUNG OF THE MINNOW, /PHOXINUS PHOXINUS/, IN MOVING AND STATIONARY SCHOOLS. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 517-520. 1978. SFA 25(1)
[PINRO, Murmansk, USSR]

80-000346 Sil'va, A.; Saburenkov, Ye. M. A STUDY OF THE ROLE OF IMITATION IN THE "VERKHOVKA", /LEUCASPIUS DELINEATUS/, IN RELATION TO SCHOOLING. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 513-517. 1978. SFA 25(1)
[Inst. Oceanol., Cuban Acad. Sci., Havana, Cuba]

80-000347 Smart, H. J.; Gee, J. H. COEXISTENCE AND RESOURCE PARTITIONING IN TWO SPECIES OF DARTERS (PERCIDAE), /ETHEOSTOMA NIGRUM/ AND /PERCINA MACULATA/. Can. J. Zool. 57 (10): 2061-2071. Oct. 1979. In English with French summ. SFA 25(1)
[Redpath Mus., McGill Univ., 859 Sherbrooke St. West, Montreal, PQ H3A 2K6, Canada] This study investigated partitioning of resources along the dimensions of space, food, and time by johnny darters (/Etheostoma nigrum/) and blackside darters (/Percina maculata/). Although both species were abundant in the midcourse of the Whitemouth River and occurred together in all habitats, space was partitioned on a vertical basis. Johnny darters were exclusively benthic whereas blackside darters were much less restricted to the bottom. The latter retained a well developed swim bladder permitting use of the vertical component of the environment. Partitioning of food resources occurred and although similar taxa were consumed by both species (aquatic insects and Crustacea) the proportions were not similar. Johnny darters fed mainly on benthic items whereas blackside darters ate pelagic items. Differences in protrusibility of premaxilla, position of the mouth and eyes, retinal acuity, and number and morphology of gill rakers reflected different modes of life. There was no evidence of partitioning by time.

80-000348 Sutterlin, A. M.; Jokola, K. J.; Holte, B. SWIMMING BEHAVIOR OF SALMONID FISH IN OCEAN PENS. J. Fish. Res. Board Can. 36 (8): 948-954. Aug. 1979. In English with French summ. SFA 25(1)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-000349 Tzvetkov, V. I. [THE INFLUENCE OF CHANGES IN BUOYANCY OF PHYSOCLISTIC FISHES ON THE EFFICIENCY OF THEIR DEFENSE-FOOD RELATIONS] Zool. Zh. 58 (6): 871-879. June 1979. In Russian with English summ. SFA 25(1)
[Inst. Anim. Evol. Morphol. Ecol., USSR Acad. Sci., Moscow, USSR] While modelling the changes in buoyancy of physoclistic fishes, we established for 3 marine and 2 fresh-water species the maximum degree of changes regulated by the fishes by means of compensatory swimming, the upper limit of "safe zone". Under the experimental conditions the efficiency of food reactions in two of these species, /Chemichromys/ and /Gasterosteus aculeatus/, suffered no changes upon any controlled changes of buoyancy. Even a small excessive buoyancy increases the availability of prey (stickleback and guppy fry) for predators. The change of methods of defense adds to the decrease of availability but upon the greater excessive buoyancy the balance between the defensive and hydrostatic motivations shifts towards the motor hydrostatic reactions thus demasking the prey and making it still more available for predators.

80-000350 Werner, R. G. HOMING MECHANISM OF SPAWNING WHITE SUCKERS IN WOLF LAKE, NEW YORK. N.Y. Fish Game J. 26 (1): 48-58. Jan. 1979. SFA 25(1)
[Coll. Environ. Sci. For. State Univ. N.Y., Syracuse] The sensory basis for homing in white suckers was examined by conducting displacement experiments in Wolf Lake (N.Y.) during the 1975 spawning run. Fish were blinded, olfactorily occluded, or released in presumably unfamiliar parts of the lake with the result that only the olfactorily occluded fish had their homing ability impaired. Analysis of the locations where test fish were recaptured suggests that olfaction may play an important role in the entry of white suckers into the spawning stream.

LIFE HISTORIES-GENERAL WORKS

80-000351 Aldonov, V. K.; Druzhinin, A. D. SOME DATA ON SCAVENGERS (FAMILY LETHRINIDAE) FROM THE GULF OF ADEN REGION. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 527-535. 1978. SFA 25(1)
[VNIRO, Moscow, USSR]

80-000352 Barbour, S. E.; Rombough, P. J.; Kerekes, J. J. A LIFE HISTORY AND ECOLOGIC STUDY OF AN ISOLATED POPULATION OF "DWARF" OUANANICHE, /SALMO SALAR/, FROM GROS MORNE NATIONAL PARK, NEWFOUNDLAND. Nat. Can. (Que.) 106 (2): 305-311. Mar.-Apr. 1979. In English with French summ. SFA 25(1)
[Biol. Dep., Dalhousie Univ., Halifax, NS B3H 4J1, Canada] Ouananiche, /Salmo salar/, occur in Gros Morne National Park on the Great Northern Peninsula of Newfoundland. They are characterized by slow growth, small size (maximum fork length = 25 cm), low fecundity (maximum 268 ova/fish, 1,500 ova/kg), a high incidence of kelt survival (56 percent of maturing female fish), and a retention of juvenile characteristics. The fish appear to be opportunistic feeders

80-000352 CONTINUED
with aquatic insects and zooplankton the major food items. The population is taxonomically indistinct from anadromous Atlantic salmon and other populations of ouananiche. Small size and repeat spawning are adaptations to a rigorous environment.

80-000353 Bednarz, J. C. ECOLOGY AND STATUS OF THE PECOS GAMBUSIA, /GAMBUSIA NOBILIS/ (POECILIIDAE), IN NEW MEXICO. Southwest. Nat. 24 (2): 311-322. 31 July 1979. SFA 25(1)
[Dep. Anim. Ecol., 124 Science II, Iowa State Univ., Ames 50011] The endangered Pecos gambusia (/Gambusia nobilis/) formerly occurred throughout the lower Pecos River drainage. In New Mexico it is presently limited to seven isolated locations at Bitter Lake National Refuge (Chaves County) and one population at Blue Spring (Eddy County). An estimate of these populations is approximately 933,500 fish. Natural cover used by the Pecos gambusia consisted of aquatic vegetation and submerged cliffs. A transplanting operation in 1973 to establish additional /G. nobilis/ populations at the refuge was successful in two of 19 attempts. Reasons for stocking failures were unknown, but water quality may have been a factor as no /G. nobilis/ were found in habitats where hardness exceeded 5,100 mg/l or conductivity greater than 28,000 micromhos. Also, the presence of green sunfish (/Lepomis cyanellus/) and the lack of aquatic vegetation were probably factors in one case. An estimated 900,000 /G. nobilis/ and over 2,000,000 /G. affinis/ were found sympatrically throughout Blue Spring. The proportion of /g. nobilis/ collected was greatest in spring flows or seepages. Pecos gambusia were found to feed on dipterans and other surface or subsurface insects of suitable size. Dissection of 20 gravid /G. nobilis/ revealed a mean of 38 plus or minus 7.6 (SD) embryos, which was significantly (P less than 0.025) less than /G. affinis/, with a mean of 56 embryos. The smallest male /G. nobilis/ found with a mature gonopodium was 22 mm, standard length.

80-000354 Burr, B. M.; Page, L. M. THE LIFE HISTORY OF THE CYPRESS DARTER, /ETHEOSTOMA PROELIARE/, IN MAX CREEK, ILLINOIS. Ill. Nat. Hist. Surv. Biol. Notes No. 106. 15p. July 1978. SFA 25(1)
[Ill. Nat. Hist. Surv., Urbana]

80-000355 De Silva, S. S.; Silva, E. I. L. BIOLOGY OF YOUNG GREY MULLET, /MUGIL CEPHALUS/ L., POPULATIONS IN A COASTAL LAGOON IN SRI LANKA. J. Fish Biol. 15 (1): 9-20. July 1979. SFA 25(1)
[Dep. Zool., Ruhuna Univ. Coll., Meddawatti, Matara, Sri Lanka] The biology of young grey mullet, /Mugil cephalus/ L. populations of a coastal lagoon--the Negombo Lagoon on the West Coast of Sri Lanka was studied from October 1976 to March 1978. The relative abundance of fry were found to vary from month to month, with peaks occurring in December-January, May and September-October, coinciding with the end of rainy seasons. It was found that the young fry tended to migrate into the lagoon at a size of about 10-20 mm, most frequently between 15-20 mm in length, by which time they were fully scaled. The young fry after a period of growth in the shallow areas of the lagoon, when they reached a size of 30-35 mm, emigrated into the deeper waters of the lagoon. The rate of growth, as computed from length frequency distribution studies, was found to be around 0.24 mm day^{-1}. Results of diurnal surveys showed a movement of the larger size fry into shallower waters during the hours of darkness and this movement appears to be independent of the tidal cycle. It is postulated that the cause of this migration is to escape from predators, chiefly piscine. Investigations of the meristic characters indicated that the young fry which migrated into the lagoon at different times of the

80-000355 CONTINUED
year probably originated from a single spawning stock.

80-000356 Dombeck, M. P. MOVEMENT AND BEHAVIOR OF THE MUSKELLUNGE DETERMINED BY RADIO-TELEMETRY. Wis. Dep. Nat. Resour. Tech. Bull. No. 113. 19p. 1979. SFA 25(1)
[Wis. Dep. Nat. Resour., Madison] External radio-transmitters were placed on 18 muskellunge in Moose Lake and Black Lake, Sawyer County, Wisconsin. Movements of the transmitter-tagged muskellunge were monitored for 14 months, during both the open water season and through the ice. Black Lake is predominantly a muskellunge, largemouth bass, panfish lake with an area of 52 ha, while Moose Lake is predominantly a muskellunge and walleye lake with an area of 676 ha. Peak movements and activities occurred in spring and fall when water temperatures were 4-12°C. During the summer months tagged fish occupied waters less than 2 m in depth at temperatures of 24-27°C. Greatest average swimming velocity of muskellunge observed was 50.8 m/minute. During winter months a tagged fish moved out of waters with low oxygen levels in the north bay of Black Lake to areas with a more abundant supply of oxygen. The monthly home range size of the muskellunge varied from 0.2 to 2.7 ha in Black Lake and from 2.3 to 27.7 ha in Moose Lake. Four spawning areas were identified and spawning activities were observed. Muskellunge moved onto spawning grounds when water temperatures reached 8-10°C and remained on spawning grounds until temperatures reached about 14°C. Spawning occurred at night in depths less than 1 m over muck/sand bottoms with much debris and dead vegetation. Spawning areas were also approximately 1.5°C warmer than adjacent waters.

80-000357 DuRant, D. F.; Shireman, J. V.; Gasaway, R. D. REPRODUCTION, GROWTH AND FOOD HABITS OF SEMINOLE KILLIFISH, /FUNDULUS SEMINOLIS/, FROM TWO CENTRAL FLORIDA LAKES. Am. Midl. Nat. 102 (1): 127-133. July 1979. SFA 25(1)
[Sch. For. Resour. Conserv., Univ. Fla., Gainesville 32611] Seminole killifish (/Fundulus seminolis/) were collected form Lake Wales, Florida, from October 1974 to June 1976 and from Star Lake during February and April 1976. Peak spawning was in April and May, but was prolonged and intermittent throughout the year. The highest gonadosomatic index for adult females (5.17) was in April, the lowest (0.01) in November. Probable spawning over /Vallisneria/ sp. was seen in March 1976. Fish spawned in 1975 grew approximately 9 mm/month. Maximum size (160+ mm) was reached in 14-18 months. Chironomids were the principal food of the adult fish: amphipods, fish eggs and plant seeds were of lesser importance. Fish under 45 mm TL ate mostly chironomids, cladocerans and ostracods. Wegener ring samples were negatively correlated with mean size of fish and gave best estimate of relative abundance for small and medium-sized fish. Seine sampling did not select for size but electrofishing sampled mostly larger fish.

80-000358 Durkee, P.; Paulson, B.; Bellig, R. SHOVELNOSE STURGEON (/SCAPHIRHYNCHUS PLATORHYNCHUS/) IN THE MINNESOTA RIVER. J. Minn. Acad. Sci. 45 (2): 18-20. 1979. SFA 25(1)
[Bemidji State Univ., Bemidji, MN] The shovelnose sturgeon, /Scaphirhynchus platorhynchus/, according to Eddy and Underhill (1974) has not been reported from the Minnesota River for a number of years. Recently, Wilcox /et. al./ (1978) reported a single adult taken in 1974, and two others in 1976. Our survey of the fishes in the Minnesota River showed a substantial number of shovelnose sturgeon, at least in certain locations. Twenty specimens were taken in 42 gill net days. Other data obtained included food habits and age-length relationships. Food habits were determined through volumetric analysis of stomach contents, and ages were obtained by sectioning the marginal

80-000358 CONTINUED
pectoral fin ray. The food analysis showed the sturgeon's diet to consist mainly of larval stages of Ceratopogonidae, Chironomidae, Tricoptera, Plecoptera, Diptera, and Coleoptera. The ages of the sturgeon ranged from four to fifteen years, while the fork lengths were from 54 to 76 centimeters.

80-000359 Eldon, G. A. HABITAT AND INTERSPECIFIC RELATIONSHIPS OF THE CANTERBURY MUDFISH, /NEOCHANNA BURROWSIUS/ (SALMONIFORMES: GALAXIIDAE). N.Z. J. Mar. Freshwater Res. 13 (1): 111-119. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] /Neochanna burrowsius/ (Phillipps) inhabits some streams at low altitudes between latitudes 43°55'S and 44°55'S in Canterbury, New Zealand. Some Habitats contain almost no open water because of concealing vegetation; others have large expanses of open, impounded water. The true habitat appears to be very slow flowing, winding, swampy streams that contain deep pools capable of storing water for long periods if flow ceases. Land drainage may have eliminated this mudfish from some places, but it has adapted to man-modified conditions in others, and may have increased in numbers in recent years. Ability to sometimes survive drought stems from its adaptation to habitats subject to low dissolved oxygen levels: there is no preparation for aestivation. Usually no other fish species are associated with it in the temporary waters it sometimes inhabits, but /Gobiomorphus breviceps/, /G. cotidianus/, /Anguilla australis/, /A. dieffenbachii/, /Galaxias maculatus/, and /G. vulgaris/ are native fishes sometimes found in association with it in permanent waters. /Salmo trutta/ and /Perca fluviatilis/ are exotic species that have been found in the same waters as /N. burrowsius/. It has been found in the stomachs of eels, trout, and perch.

80-000360 Eleftheriou, A. SANDY BEACHES AS FLATFISH NURSERIES. Scott. Fish. Bull. 45: 23-26. 1979. SFA 25(1)

80-000361 Gaygalas, K. S.; Blatnene, D. P.; Pyatravichyute, G. V. ON SOME MORPHOECOLOGICAL PECULIARITIES, POPULATION STRUCTURE AND EXPLOITATION OF STOCKS OF THE WHITE BREAM, /BLICCA BJOERKNA/, IN COURLAND LAGOON. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 386-393. 1978. SFA 25(1)
[Inst. Zool. Parasitol., Lithuanian SSR Acad. Sci., Vilnius, USSR]

80-000362 Hambrick, P. S.; Robison, H. W. LIFE HISTORY ASPECTS OF THE PALEBACK DARTER, /ETHEOSTOMA PALLIDIDORSUM/ (PISCES: PERCIDAE), IN THE CADDO RIVER SYSTEM, ARKANSAS. Southwest. Nat. 24 (3): 475-484. 15 Sept. 1979. SFA 25(1)
[Chateau Cleary Apt., Apt. 408, 3900 I-10 Service Rd., Metairie, LA 70001] Further observations on the restricted distribution and additional habitat notes are provided for the paleback darter, /Etheostoma pallididorsum/, that support concerns for its survival. A Status of threatened is consequently recommended. Several aspects of feeding and reproductive biology of this darter were obtained from analysis of gut contents and gonadal conditions. Dominant food items were cladocerans, ephemeropterans, and dipteran larvae, while maximum spawning activity appears to occur in February and March, ending by early summer. The more serious threats to survival and suggested conservation measures are discussed.

80-000363 Harrison, E. J.; Hadley, W. F. BIOLOGY OF MUSKELLUNGE (/ESOX MASQUINONGY/) IN THE UPPER NIAGARA RIVER. Trans. Am. Fish. Soc. 108 (5): 444-451. Sept. 1979. SFA 25(1)
[Dep. Biol. Pesq., Fund. LaSalle, Isla de Margarita, Venezuela]

80-000364 Heins, D. C. A COMPARATIVE LIFE HISTORY OF A CLOSELY RELATED GROUP OF MINNOWS (/NOTROPIS/, CYPRINIDAE) INHABITING STREAMS OF THE GULF COASTAL PLAIN. Ph.D. dissertation, Tulane Univ. 168p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(3):1082. Sept. 1979. SFA 25(1)

80-000365 Hubbs, C.; Dean, S. M. GROWTH AND REPRODUCTIVE RESPONSES OF /MENIDIA BERYLLINA/ (ATHERINIDAE) INHABITING LAKE TEXOMA. Southwest. Nat. 24 (3): 546-549. 15 Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Tex. Austin, Austin 78712]

80-000366 Hureau, J.-C.; Geistdoerfer, P.; Rannou, M. THE ECOLOGY OF DEEP-SEA BENTHIC FISHES. Sarsia 64 (1/2): 103-108. 1979. SFA 25(1)
[Mus. Natl. Hist. Nat., Lab. Ichtyol., 43 rue Cuvier, 75231 Paris Cedex 05, France] Despite the relative stability of physico-chemical factors of the deep sea, it has been shown that a cyclic activity exists in the growth, reproduction, and feeding of some abyssal fishes. Viviparity and hermaphroditism are two rather frequent phenomena among such fishes. The trophic ecology of different species is particularly interesting, because it makes it possible to distinguish several ecological types and to refute certain false ideas such as 'Macrourids are sediment eaters'. Euryphagy and microphagy seem to constitute adaptations to life in abyssal regions. Growth which has been studied mainly in macrourids, appears to be definitely much slower than in fishes belonging to other biotopes. Geographical distribution is quite noteworthy when it concerns abyssal fish: for example, a single species can be found at antipodal points. The deep-sea currents have a particular role in the faunal exchanges between the great ocean basins.

80-000367 Kobylinski, G. J.; Sheridan, P. F. DISTRIBUTION, ABUNDANCE, FEEDING AND LONG-TERM FLUCTUATIONS OF SPOT, /LEIOSTOMUS XANTHURUS/, AND CROAKER, /MICROPOGONIAS UNDULATUS/, IN APALACHICOLA BAY, FLORIDA, 1972-1977. Contrib. Mar. Sci. 22: 149-161. Aug. 1979. SFA 25(1)
[Bur. Water Anal., Fla. Dep. Environ. Regulation, Tallahassee 32301] Seasonal distribution, abundance and trophic functions of /Leiostomus xanthurus/ and /Micropogonias undulatus/ were studied at a series of stations in Apalachicola Bay, Florida. Highest catch/effort of spot was found in upper East Bay and East Bay. Apalachicola Bay and East Bay yielded the greatest catch/effort of croaker. Abundance of the two species peaked in the spring and declined in the fall. Stomach contents showed croaker and spot are primarily omnivorous. Principal foods of spot included polychaetes, harpacticoid copepods, detritus and bivalves. Croaker consumed primarily polychaetes and detritus. Comparison of diets of croaker and spot revealed high intraspecific similarity on a size class basis and high interspecific similarity on an areal basis. Population fluctuations and spatial distribution of croaker and spot were studied as a response to a number of environmental and trophic factors. Presence or absence of benthic macrophytes, salinity, color and turbidity, bottom type and food availability determined the long-term spatial distribution of the two fishes. Temperature is a critical parameter for at least one of these

80-000367 CONTINUED
species while variations in rainfall and river flow have little effect on either population.

80-000368 MacKay, K. T. SYNOPSIS OF BIOLOGICAL DATA OF THE NORTHERN POPULATION ATLANTIC MACKEREL (/SCOMBER SCOMBRUS/). Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 885. vi + 26p. June 1979. In English with French summ. SPA 25(1)
[Bedford Inst. Oceanogr., Dartmouth, NS, Canada] The northern population of Atlantic mackerel, /Scomber scombrus/ L., spawns in the Magdalen Shallows during June. The adults remain in the Gulf of St. Lawrence where they build up fat while feeding on zooplankton. Juvenile fish are found in inshore areas of the Canadian Atlantic from July to October. They feed on larger food particles than the adults. Mackerel leave Canadian waters in October. The southern population spawns south of Long Island during April-May and moves northward to the Gulf of Maine during summer. Stragglers may occasionally reach Canadian waters. Both populations overwinter in deep water along the Continental Slope where they have been heavily exploited by a winter fishery which peaked at 386,000 metric tons (MT) in 1972. Two year-classes have dominated the northern population; both have grown slower and matured later than the other year-classes. Somatic weights and gonad weights vary from year to year but seasonal variations are greater than yearly variations. While ovaries and testes do not differ in weight, the dry weight content of ovaries is higher. Mackerel are obligate schoolers during the day. School size varies from 1000 fish in St. Margaret's Bay to 10,000 fish on the north shore of Prince Edward Island and to 80,000 fish during winter in the Georges Bank area.

80-000369 Magomedov, G. M.; Murzabekova, N. M. FEEDING AND GROWTH OF THE YOUNG AUTUMN CHUM SALMON, /ONCORHYNCHUS KETA/, ACCLIMATIZED IN THE CASPIAN SEA DURING THE RIVER PERIOD OF LIFE. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 683-686. 1978. SPA 25(1)
[Dagestan Dep., Caspian Fish. Res. Inst., Makhachkala, USSR]

80-000370 McCosker, J. E.; Lagios, M. D. THE BIOLOGY AND PHYSIOLOGY OF THE LIVING COELACANTH. Calif. Acad. Sci. Occas. Pap. No. 134. 175p. 22 Dec. 1979. SPA 25(1)
[Calif. Acad. Sci., Golden Gate Park, San Francisco, CA 94118]

80-000371 Michaelson, D. M.; Sternberg, D.; Fishelson, L. OBSERVATIONS ON FEEDING, GROWTH AND ELECTRIC DISCHARGE OF NEWBORN /TORPEDO OCELLATA/ (CHONDRICHTHYES, BATOIDEI). J. Fish Biol. 15 (2): 159-163. Aug. 1979. SPA 25(1)
[Dep. Biochem., George S. Wise Fac. Life Sci., Tel-aviv Univ., Tel-aviv, Israel] Newly born and neonate /Torpedo ocellata/ were obtained from gravid females caught during the autumn off the Mediterranean coast of Israel. The young torpedos, which weighed about 11 g, were fed with live /Blennius pavo/ Risso, and doubled their weight in about 4 months. The behaviour of the torpedo during feeding was examined and photographed. When attacking a fish, the torpedo emerges from being buried in the sand and assaults the approaching prey. First, the prey is trapped under the torpedo and then directed towards the ray's mouth by its body movements. Newborn and neonate torpedos are able to discharge their electric organ. The amplitude of the discharge of one day-old fish is approximately 4 V. It increases dramatically during the first three weeks of life to 20 V, reaching an asymptotic level of about 26 V, by the end of the fourth month.

80-000372 Moffett, A. W.; McEachron, L. W.; Key, J. G. OBSERVATIONS ON THE BIOLOGY OF SAND SEATROUT (/CYNOSCION ARENARIUS/) IN GALVESTON AND TRINITY BAYS, TEXAS. Contrib. Mar. Sci. 22: 163-172. Aug. 1979. SFA 25(1)
[Tex. Parks Wildl. Dep., Seabrook Mar. Lab. 77586] Sand seatrout (/Cynoscion arenarius/) is of commercial and recreational importance to the Gulf states. Spawning behavior, feeding habits, length-weight relationships and standard length-total length relationships were determined for 498 sand seatrout collected between May 1966 and March 1969 from Galveston and Trinity Bays, Texas and from the Gulf of Mexico near Galveston Island. Sand seatrout distribution, gonadal development and the time young-of-the-year appeared in estuaries indicated that this species spawns near Gulf-to-bay passes in the Gulf of Mexico between March and August with a spawning peak during spring. Fish and crustaceans dominated the diet of sand seatrout, crustaceans occurred more frequently in fish less than 160 mm SL and fish predominated in those greater than 160 mm SL. The length-weight regressions derived from 267 sand seatrout 125-375 mm SL differed between sexes. The standard length-total length relationship was TL=0.7 + 1.1 SL.

80-000373 Nagelkerken, W. P. BIOLOGY OF THE GRAYSBY, /EPINEPHELUS CRUENTATUS/, OF THE CORAL REEF OF CURACAO. Stud. Fauna Curacao Other Caribb. Isl. 60 (186): 1-118. 1979. SFA 25(1)
[Caraibisch Mar.-Biol. Inst., Curacao]

80-000374 Reimers, N. A HISTORY OF A STUNTED BROOK TROUT POPULATION IN AN ALPINE LAKE: A LIFESPAN OF 24 YEARS. Calif. Fish Game 65 (4): 196-215. Oct. 1979. SFA 25(1)
[Sierra Nevada Aquatic Res. Lab., Star Route 1, Box 198, Mammoth Lakes, CA 93546] The last known survivor of an experimentally stocked population of brook trout lived well into its 24th year of life in a small, High Sierra lake. This extreme longevity doubles previous age record for the species and is attributed to a combination of food scarcity, low temperature, and a remote environment where the influence of angling was negligible. As a consequence of early overcropping and decimation of invertebrate food organisms, semistarvation and stunting continued throughout the lives of originally stocked trout. Natural propagation was repressed until age 16 years. Growth was near normal for the few second-generation fish, which arrived late enough to inherit improved forage due to attrition of the parent generation. Laboratory culture of some of the aging trout (12-18 years) demonstrated capacity for regrowth with sustained nutrition. A breeding experiment with 14-year-olds produced no viable offspring, but cross-fertilization with young brook trout indicated limited fertility in both sexes at advanced age. Histological evaluations at ages 12, 13, 14, and 18 years sought to correlate degenerative changes in vital systems with chronological age. Old trout were distinguishable from their young counterparts only by minor, "wear-and-tear" changes until very late in life. Gross developmental anomalies were found in generative cells and tissues of nearly all mature specimens examined but could not be definitely linked to physiological aging. Fin-clipped individuals permitted identification of the stocked group for 19 years. Otoliths were used to verify ages up to 24 years.

80-000375 Richards, S. W.; Mann, J. M.; Walker, J. A. COMPARISON OF SPAWNING SEASONS, AGE, GROWTH RATES, AND FOOD OF TWO SYMPATRIC SPECIES OF SEAROBINS, /PRIONOTUS CAROLINUS/ AND /PRIONOTUS EVOLANS/, FROM LONG ISLAND SOUND. Estuaries 2 (4): 255-268. Dec. 1979. SFA 25(1)
[Little Harbor Lab., 69 Andrews Rd., Guilford, CT 06437] Both species entered the Sound in April and spawned during June and July. /P. evolans/ appeared to spawn slightly earlier in summer than /P. carolinus/. Adults began to leave the Sound after spawning and were usually absent after November. Young-of-the-year were taken regularly from August to November and, occasionally in water over 20 m deep, into February when the bottom water temperature was 1.4°C. At the end of the first growing seasons both species exhibited large variations in standard lengths. Back-calculations from scale annuli measurements indicated that linear growth rates during the juvenile years were similar in both species. However, /P. evolans/ was considerably heavier than /P. carolinus/. During adulthood /P. evolans/ was not only longer and heavier than /P. carolinus, but lived longer. Growth rates are described by the following equations: /P. carolinus/ $L(t+1) = 9.60 + 0.68\ (L(t))$ and /P. evolans $L(t+1) = 7.70 + 0.80\ (L(t))$. Both species were opportunistic feeders, and crustaceans were clearly the dominant group of prey. Young-of-the-year, between 3-6 cm, ate copepods. As they grew they ate larger prey, such as /Neomysis americana/, /Diastylis quadrispinosus/, various species of amphipods of small sizes, and juvenile /Crangon septemspinosus/. Older fish ate larger sizes of these same prey, a number of species of crabs, juvenile /Homarus americanus/, and /Squilla empusa/. Occasionally they ate polychaetes, molluscs, and junvenile fish. Partitioning of the resources of Long Island Sound by these two species appeared to be by prey size. /P. evolans ate prey that, on the average, were slightly larger than those eaten by /P. carolinus/. Furthermore, /P. evolans/ ate a greater amount of nektonic species than /P. carolinus/, which appeared to prefer benthonic invertebrates.--From abstr.

80-000376 Schmidt, R. E.; Whitworth, W. R. DISTRIBUTION AND HABITAT OF THE SWAMP DARTER (/ETHEOSTOMA FUSIFORME/) IN SOUTHERN NEW ENGLAND. Am. Midl. Nat. 102 (2): 408-413. Oct. 1979. SFA 25(1)
[Biol. Dep., Fordham Univ., Bronx, NY 10458] Selected aspects of the ecology of the swamp darter (/Etheostoma fusiforme/) were investigated to verify its distribution, to collect life history data and to reconstruct its geographic history in southern New England. The unusual distribution pattern in Connecticut was confirmed. Ponds with vegetation and detrital sediments were preferred habitats of this species. Stream populations were very small and probably depended on pond populations for recruitment. Important food items of /E. fusiforme/ in Connecticut were midges and Cladocera. Individuals with more than one annulus were never captured. We postulate that /E. fusiforme/ entered New Engladn via the eastern tip of Long Island very late in postglacial time and that the distribution in Connecticut is a result of postglacial drainage patterns and dispersal through extinct and extant intersystem connections.

80-000377 Silverman, M. J. BIOLOGICAL AND FISHERIES DATA ON BLACK DRUM, /POGONIAS CROMIS/ (LINNAEUS). Natl. Mar. Fish. Serv. Sandy Hook Lab. Tech. Ser. Rep. No. 22. vii + 35p. Oct. 1979. SFA 25(1)
[NMFS, Sandy Hook Lab., NJ]

80-000378 Usynin, V. F. THE BIOLOGY OF THE CHULYM RIVER STERLET, /ACIPENSER RUTHENUS/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 548-555. 1978. SFA 25(1)
[Dep. Ichthyol. Hydrobiol., Tomsk Univ., USSR]

80-000379 van den Broek, W. L. F. ASPECTS OF THE BIOLOGY OF /SPRATTUS SPRATTUS/ (L.) IN THE MEDWAY ESTUARY. J. Fish Biol. 15 (4): 437-447. Oct. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19-062, Wellington, New Zealand] Fish samples were taken monthly over an eight-hour day period between 1973 and 1975. In addition, separate night samples were collected during 1974-75. The present study considers the sprat component of the catch and examines aspects of the fish's biology and its accumulation of chlorinated hydrocarbon compounds and heavy metals. Sprats were present on every sampling date and, generally, totals were highest during late autumn/early winter. They formed 61.1 percent of the catch by numbers and 17.5 percent by weight. Night samples contained an unexpectedly large number of sprats and with mean lengths significantly greater than those in day samples. Changes in monthly length-frequency distributions suggested double spawning during 1974, perhaps the result of a mild winter. Sprats were infected with two copepod ectoparasites; /Lernaeenicus sprattae/ (Sowerby) and /L. encrasicola/ (Turton). In each case infection was low, affecting only 6.6 and 0.9 percent of the population respectively. Levels of chlorinated hydrocarbons and heavy metals were also low in whole sprat tissue. Values of total DDT, dieldrin and PCBs were at a maximum in winter and minimum in spring. Heavy metal results showed no seasonal pattern.

80-000380 Yoshida, H. O. SYNOPSIS OF BIOLOGICAL DATA ON TUNAS OF THE GENUS /EUTHYNNUS/. NOAA Tech. Rep. NMFS Circ. 429. iv + 57p. Oct. 1979. SFA 25(1)
[NMFS, Southwest Fish. Cent. Honolulu Lab., Honolulu, HI 96812]

POPULATION STUDIES, PRODUCTION, ETC.

80-000381 Birman, I. B. ON THE SIMILARITY IN THE POPULATION DYNAMICS OF THE CANADIAN SALMON, /SALMO SALAR/, AND THE AMUR AUTUMN CHUM, SALMON, /ONCORHYNCHUS KETA/ INFRASPECIES /AUTUMNALIS/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 672-677. 1978. SFA 25(1)
[Pac. Ocean Inst. Sea Fish. Oceanogr., Petropavlovsk-Kamchatskiy, USSR]

80-000382 Goldspink, C. R. THE POPULATION DENSITY, GROWTH RATE AND PRODUCTION OF ROACH /RUTILUS RUTILUS/ (L.) IN TJEUKEMEER, THE NETHERLANDS. J. Fish Biol. 15 (4): 473-498. Oct. 1979. SFA 25(1)
[Dep. Biol. Sci., Manchester Polytech., Chester St., Manchester, England] A method of estimating the population density of roach in Tjeukemeer (21.3 km²) using 20,529 introduced fin-clipped fish is described. Fyke nets proved to be an effective method of sampling the population for marked fish during the spawning season. A total of 20,277 roach were processed during the recapturing period. The population density of roach (≥ 14 cm) was estimated to be 1,246,458. The growth rate of roach in the lake although relatively poor (von Bertalanffy's L infinity for males and females, 22 and 26 cm respectively) for the species was similar to that recorded in three other Fresian lakes. The

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mortality rate of males was higher than that of females. Logarithmic length-weight regression analyses showed that the value of the coefficient varied both within and between the sexes, that of females being higher (range 3.038-3.375) than that of males (range 2.760-3.254). Seasonal changes in the size of the coefficient were due to a disproportionate loss of gonad weight in larger fish. The fecundity of the population was comparatively high for the species. The total production of the population was estimated to be 95 kg ha^{-1} of which 39 kg ha^{-1} was contributed by fry. In older (≥ IV) fish the production of females (12 kg ha^{-1}) exceeded that (2 kg ha^{-1}) of males, due to differences in their growth and mortality rates. The relatively poor performance of roach in Tjeukemeer, in terms of biomass and production was due to a scarcity of zoobenthos and competition from other species of fish. There is no evidence either from this study or the literature that the productive potential of roach in lakes is high, even though macrophytes and detritus can be consumed in significant amounts.

80-000383 Milner, N. J.; Gee, A. S.; Hemsworth, R. J. RECRUITMENT AND TURNOVER OF POPULATIONS OF BROWN TROUT, /SALMO TRUTTA/, IN THE UPPER RIVER WYE, WALES. J. Fish Biol. 15 (2): 211-222. Aug. 1979. SFA 25(1)
[UWIST Field Cent., Newbridge on Wye, Llandrindod Wells, Powys, Wales] The age structure, abundance, net immigration and loss of trout populations were investigated in eleven tributary sites and two main river sites on the River Wye. Marking experiments indicated that recruitment to the site populations was mainly by immigration which began during the 0-group phase and continued, with seasonal fluctuations, throughout life. Immigrant fish had a higher probability of being lost from the populations than residents providing a statistical distinction between mobile and sedentary components of the population. The turnover of the site populations is described using a simple exponential model, and half-times at different sites (stream length, 50 m) ranged from 140 to 430 days. Some factors affecting half-times are briefly discussed.

80-000384 Murawski, S. A.; Waring, G. T. A POPULATION ASSESSMENT OF BUTTERFISH, /PEPRILUS TRIACANTHUS/, IN THE NORTHWESTERN ATLANTIC OCEAN. Trans. Am. Fish. Soc. 108 (5): 427-439. Sept. 1979. SFA 25(1)
[NMFS, Woods Hole, MA 02543]

80-000385 Pella, J. J.; Robertson, T. L. ASSESSMENT OF COMPOSITION OF STOCK MIXTURES. NOAA Fish. Bull. 77 (2): 387-398. Apr. 1979. SFA 25(1)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

80-000386 Thorne, R. E. HYDROACOUSTIC ESTIMATES OF ADULT SOCKEYE SALMON (/ONCORHYNCHUS NERKA/) IN LAKE WASHINGTON, 1972-75. J. Fish. Res. Board Can. 36 (9): 1145-1149. Sept. 1979. In English with French summ. SFA 25(1)
[Fish. Res. Inst., Coll. Fish., Univ. Wash., Seattle 98195]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

80-000387 Altukhov, K. A. ON THE REPRODUCTION AND ABUNDANCE OF THE LESSER SAND LANCE, /AMMOLYTES MARINUS/, IN THE WHITE SEA. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 560-567. 1978. SFA 25(1)
[L'vov Dep. Ukrainian Fish. Res. Inst., USSR]

80-000388 Apekin, V. S.; Vilenskaya, N. I. A DESCRIPTION OF THE SEXUAL CYCLE AND THE STATE OF THE GONADS DURING THE SPAWNING MIGRATION OF THE STRIPED MULLET, /MUGIL CEPHALUS/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 446-456. 1978. SFA 25(1)
[VNIRO, Moscow, USSR] The results are given of an investigation of migrations and of peculiarities of functioning of the gonads of the striped mullet, /Mugil cephalus/, entering the Sea of Azov to feed. Gonads from stages II-III up to functional maturity develop during the prespawning period. The spawning migration lasts from the beginning of June to the middle of August. The ripeness of females fluctuates considerably in the schools. The growth and final size of the oocytes evidently depend on temperature conditions during foraging. A set of characters for the selection of females from which ripe ova can be obtained was investigated.

80-000389 Atkinson, D. B.; Carscadden, J. E. BIOLOGICAL CHARACTERISTICS OF INSHORE CAPELIN, /MALLOTUS VILLOSUS/ (MULLER), JUNE-JULY 1977. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 881. iv + 18p. May 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., P.O. Box 5667, St. John's, NF A1C 5X1, Canada] During the period late May to early July 1977, capelin were collected during a project conducted in Conception and Trinity bays by the Industrial Development Branch of the Fisheries and Marine Service to investigate the commercial feasibility of selectively harvesting ripe female capelin during their spawning period in inshore Newfoundland waters. Capelin schools were classified into five types according to size and density as observed from echo sounder records. Schools became larger and denser as the spawning season progressed and denser schools were usually found in shallower water. Sets made from the beach yielded a high percentage of male capelin while sets made from the purse seiner yielded catches containing 24-87 percent females. Older and larger fish predominated early in the season. Examination of gonads confirmed the results of earlier studies that males mate over an extended period, but females spawn during a very short period.

80-000390 Beumer, J. P. REPRODUCTIVE CYCLES OF TWO AUSTRALIAN FRESHWATER FISHES: THE SPANGLED PERCH, /THERAPON UNICOLOR/ GUNTHER, 1859 AND THE EAST QUEENSLAND RAINBOWFISH, /NEMATOCENTRIS SPLENDIDA/ PETERS, 1866. J. Fish Biol. 15 (1): 111-134. July 1979. SFA 25(1)
[Fish. Wildl. Div., Arthur Rylah Inst. Environ. Res., Brown St., Heidelberg, Victoria 3084, Australia] The reproductive cycles of the spangled perch /Therapon unicolor/ Gunther, 1859 and the East Queensland rainbowfish /Nematocentris splendida/ Peters, 1866 are described in terms of maturity stages, sex-ratio, gonosomatic indices, oocyte diameters, fecundity and rearing experiments. /T. unicolor/ has a well-defined reproductive cycle with gonad development stimulated by rising temperatures and increasing daylength; with spawning induced by the 'wet', possibly by rising water levels and increasing turbidities. In contrast, /N. splendida/ has a protracted spawning period with a peak of spawning activity in pre-flood and flood periods, although

80-000390 CONTINUED
individuals in spawning condition and juveniles may be found throughout the year.

80-000391 Chebanov, N. A. BEHAVIOR AND MATE SELECTION AMONG CHUM SROOK STOCK OF DIFFERENT SIZES WITH A PREDOMINANCE OF MALES IN THE SPAWNING GROUNDS. Sov. J. Ecol. (Engl. Transl. Ekologiya) 10 (2): 141-146. Nov. 1979. SFA 25(1)
[Kamchatka Sect., Pac. Res. Inst. Fish. Oceanogr., USSR] The behavior of 8 females and 23 chum males (/Oncorhynchus keta/, Walbaum) labeled with cloth labels was studied in spawning ground. The predominance of males resulted in the selection of adults of similar size in comparison with spawning pairs only among average and large fish. The use of unique indices (intensity of active and inactive migration in the spawning grounds, spawning activity, incomplete utilization of sexual products, life span in the spawning ground) permitted the evaluation to a certain extent of the role of males from different size groups during spawning.

80-000392 Dahlgren, B. T. THE EFFECTS OF POPULATION DENSITY ON FECUNDITY AND AND FERTILITY IN THE GUPPY, /POECILIA RETICULATA/ (PETERS). J. Fish Biol. 15 (1): 71-91. July 1979. SFA 25(1)
[Dep. Anim. Ecol., Univ. Lund, Ecol. Bldg., S-223 62 Lund, Sweden] The frequency of females with only ova or with different combinations of reproductive units and developmental stages in the ovary was significantly different between different densities but not between females with one and two gestations from the same population density. The ovarian width of females with one gestation from the lowest density was significantly larger than in the highest population density. gonad length and height and ovarian volume of females with two gestation periods were larger in the lowest compared with the highest density. After one gestation, females at the lowest population level had greater ovarian length, height, gonad weight, width and volume compared with those from the higher density. Ovarian length, height and volume and gonad weight were also significantly greater among females of two gestation periods in the lowest than in the second lowest density. The average gonadosomatic ratio was highest in the lowest population density. A significant correlation was found between gonad volume and total body weight and between gonad volume and ovarian weight of females at every population level. This was also the case when ovarian weight vs. total body weight was examined in each population density. Only at the lowest population level was there a significant correlation between fecundity and total body length and between fertility and body length. A significant relationship was also found between gonad volume and total body length and between gonad weight and body length at the same population level. No significant difference of fecundity and ovum size was found between females of one and two gestation periods from the same density. Fecundity and fertility were significantly higher among females of one and two gestation periods from the lowest than from the highest density.-From abstr.

80-000393 Datta Munshi, J. S.; Bilgrami, K. S.; Saha, M. P.; Johar, M. A. O. SURVEY OF FISH-SPAWN COLLECTION GROUNDS IN THE RIVER GANGES. Environ. Conserv. 6 (2): 153-157. 1979. SFA 25(1)
[Postgrad. Dep. Zool., Bhagalpur Univ., Bhagalpur-812007, Bihar, India]

80-000394 Fricke, H. W. MATING SYSTEM, RESOURCE DEFENCE AND SEX CHANGE IN THE ANEMONEFISH /AMPHIPRION AKALLOPISOS/. J. Comp. Ethól. 50 (3): 313-326. July 1979. In English with German summ. SFA 25(1)
[Max Planck Inst. Verhaltensphysiol., D-8131, Seewiesen, West Germany]

80-000395 Geistdoerfer, P. NEW DATA ON THE REPRODUCTION OF MACROURIDS (TELEOSTEI, GADIFORMES). Sarsia 64 (1/2): 109-112. 1979. SFA 25(1)
[Mus. Natl. Hist. Nat., 43 rue Cuvier, 75231 Paris Cedex 05, France]

80-000396 Habib, G. REPRODUCTIVE BIOLOGY OF THE PUFFERFISH, /URANOSTOMA RICHEI/ (PLECTOGNATHI: LAGOCEPHALIDAE), FROM LYTTELTON HARBOUR. N.Z. J. Mar. Freshwater Res. 13 (1): 71-78. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19062, Wellington, New Zealand] The gonads of 15,163 pufferfish, /Uranostoma richei/ (Freminville), taken from Lyttelton Harbour, South Island, New Zealand between June 1969 and May 1970 were examined: 8892 were female, 6271 male. A smaller number of gonads and livers were examined in detail. The occurrence of fish at different stages of gonad development during the year, and associated changes in gonad weight, were used to define the breeding season as October to March. Peak spawning occured in December; spawning fish were over 7.5 cm in length, 9 g in weight, and 2 years of age. Fecundity (counts of eggs over 0.4 mm diam.) was proportional to the cube of fish length, and ranged from 5000 in a fish of 8 cm to 100,000 in an 18-cm-long fish. There was some evidence that the liver acts as a food store that is utilised in gonad development before spawning.

80-000397 Hawkins, A. D.; Urquhart, G. G.; Shearer, W. M. THE COASTAL MOVEMENTS OF RETURNING ATLANTIC SALMON, /SALMO SALAR/ L. Scott. Fish. Res. Rep. No. 15. 14p. 1979. SFA 25(1)
[Mar. Lab., Aberdeen, Scotland]

80-000398 Hlavek, R. R.; Norden, C. R. THE REPRODUCTIVE CYCLE AND FECUNDITY OF THE ALEWIFE IN LAKE MICHIGAN. Wis. Acad. Sci. Arts Letters 66: 80-90. 1978. SFA 25(1)
[Marian Coll., Indianapolis, IN] The alewife population in southen Lake Michigan exhibited a spawning season extending from mid-June to Early August, with a peak in July, as indicated by gonosomal indices and confirmed from histological sections of the ovaries and testes. During the height of spawning, gonads comprised 5 to 6 percent of body weight in males and 8 to 12 percent in females, values approximately nine times as great as in the quiescent season. The relationship between fecundity and total length was expressed as Y=292X-29,719. The correlation coefficient was .44. Fecundity versus ovarian weight was Y=4,819X - 1,262, with a correlation coefficient of .90. Fecundity was related to the gonosomal index by Y=2,352X-3,801, with a correlation coefficient of .71. Gonosomal indices of dying fish revealed various states of sexual development.

80-000399 Jilek, R.; Cassell, B.; Peace, D.; Garza, Y.; Riley, L.; Siewart, T. SPAWNING POPULATION DYNAMICS OF SMELT, /OSMERUS MORDAX/. J. Fish Biol. 15 (1): 31-35. July 1979. SFA 25(1)
[Dep. Zool., Ohio State Univ., Columbus 43210] A total of 1618 /Osmerus mordax/ were collected between 27 April and 5 May 1977 from five spawning sites along Lake Superior. The fish were measured, sexed, and aged to determine spawning population dynamics. Length/weight ratios of males vs. females varied with males' growth initially concentrated towards length, while females' growth was concentrated toward weight. These growth curves reverse after the third-year class. Male /O. mordax/ exhibit a higher coefficient of condition.

80-000400 Lehtinen, S.; Echelle, A. A. REPRODUCTIVE CYCLE OF /NOTROPIS BOOPS/ (PISCES: CYPRINIDAE) IN BRIER CREEK, MARSHALL COUNTY, OKLAHOMA. Am. Midl. Nat. 102 (2): 237-243. Oct. 1979. SFA 25(1)
[Dep. Life Sci., Okla. State Univ., Stillwater] The reproductive cycle of the big eye shiner (/Notropis boops/) in Brier Creek, S-central Oklahoma, is described for 1976 and 1977. Reproduction occurred from late April into August. The breeding season was longer and began earlier in the year than those of northern populations of the species. Ovarian regression began earlier in the 1977 breeding season than in 1976; this coincided with higher summer temperatures and more extreme drought conditions in 1977. Most individuals spawn during their 2nd summer of life with only a few surviving to spawn the following season. None spawn in their year of birth. Egg diameter frequencies suggest that individuals spawn more than one clutch per season. Compared to /Notropis lutrensis/ and /N. venustus/, synoptic congeners of more southern origins, /N. boops/ seemed more sensitive to stressful drought conditions of 1977.

80-000401 Moiseyeva, Ye. B.; Rudenko, V. I. THE SPAWNING OF THE ROUND GOBY, /GOBIUS MELANOSTOMUS/, UNDER AQUARIUM CONDITIONS IN WINTER. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 690-692. 1978. SFA 25(1)
[AzCherNIRO, Kerch, USSR]

80-000402 Nieman, D. A.; Clady, M. D.; Gebhart, G. E. SEXUAL MATURITY OF SMALL YEARLING LARGEMOUTH BASS IN OKLAHOMA. Proc. Okla. Acad. Sci. 59: 51-52. 1979. SFA 25(1)
[Okla. Dep. Wildl. Conserv., 1801 N. Lincoln Blvd., Oklahoma City 73105]

80-000403 Pratt, H. L., Jr. REPRODUCTION IN THE BLUE SHARK, /PRIONACE GLAUCA/. NOAA Fish. Bull. 77 (2): 445-470. Apr. 1979. SFA 25(1)
[NMFS, Narragansett, RI 02882] In the male blue shark, /Prionace glauca/, paired testes produce spermatozoa year round which are stored first in the epididymides, then as spermatophores in the lower ductus deferentia. Spermatozoa are transferred to the female through paired claspers employed singly. Spermatozoa are injected into the upper vagina and pass through the uterus and isthmus into the shell (oviducal) gland, where they are stored until the female is ready for fertilization. Male blue sharks reach maturity at 183 cm fork length when 50 percent possess spermatophores. Females pass through a subadult phase (145-185 cm), when the organs for copulation and sperm storage are developed but the ova are undeveloped. During this phase females receive numerous toothcuts in their thickened dermis as a prelude to mating and frequently copulate. I examined reproductive

80-000403 CONTINUED
organs from 160 subadult female blue sharks, caught in shelf waters off southern New England during summer months, by histological sectioning to determine if spermatatozoa were present. Of these females, 79 had spermatozoa in the oviducal gland, establishing successful copulation. Inseminated females then emigrate offshore where fertilization occurs the following spring during ovulation. Blue sharks are viviparous and bear young after 9 to 12 months gestation. Thirty-eight new or unpublished accounts of gravid females are investigated, as well as one 192 cm hermaphroditic blue shark. In shelf waters during the summer the sex ratio for subadults is nearly equal while males dominate the adult sizes due to the emigration of inseminated females.

80-000404 Ramanathan, N.; Natarajan, R. BREEDING BIOLOGY OF /PSETTODES ERUMEI/ (BLOCH & SCHN.) AND /PSEUDORHOMBUS ARSIUS/ (HAM. BUCH.) PISCES: PLEURONECTIFORMES ALONG PORTO NOVO COAST (S. INDIA). Aquaculture 18 (3): 269-282. Nov. 1979. SFA 25(1)
[Cent. Adv. Stud. Mar. Biol., Annamalai Univ., Parangipettai 608 502, Tamil Nadu, India] Studies on the development of ova up to maturity clearly indicated that /Psettodes erumei/ and /Pseudorhombus arsius/ breed only once a year for 3 to 4 months in Porto Novo waters. /Psettodes erumei/ spawns its eggs in two batches, while /Pseudorhombus arsius/ spawns in a single batch. The spawning period of /Psettodes erumei/ was from May to September, with the peak from May to August. /Pseudorhombus arsius/ spawns during April to July, with the peak in April and May. Studies on the gonadosomatic indices confirm the above information. The size at first maturity of /Psettodes erumei/ was 371-390 mm total length, and that of /Pseudorhombus arsius/ was between 161 and 170 mm total length. Females always outnumbered males in both the species. Fecundity studies in both species showed direct correlations with total length and body weight.

80-000405 Rothbard, S. OBSERVATIONS ON THE REPRODUCTIVE BEHAVIOR OF /TILAPIA ZILLII/ AND SEVERAL /SAROTHERODON/ SPP. UNDER AQUARIUM CONDITIONS. Bamidgeh 31 (2): 35-43. June 1979. SFA 25(1)
[Fish Aquacult. Res. Stn., Dor, Israel]

80-000406 Savvaitova, K. A.; Maksimov, V. A. THE SPAWNING OF THE ARCTIC LAMPREY OF THE GENUS /LAMPETRA/ IN CONNECTION WITH THE PROBLEM OF THE TAXONOMIC STATUS OF SMALL FORMS. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 555-560. 1978. SFA 25(1)
[Dep. Ichthyol., Moscow Univ., USSR]

80-000407 Schofer, W. UNTERSUCHUNGEN ZUR FORTPFLANZUNGSFAEHIGKEIT DER PLOETZE (/RUTILUS RUTILUS/ L.) IM BRACKWASSER. [INVESTIGATIONS ON THE CAPABILITY OF ROACH (/RUTILUS RULTILUS/ L.) TO REPRODUCE IN BRACKISH WATER.] Arch. Hydrobiol. 86 (3): 371-395. 1979. In German with English summ. SFA 25(1)
[Inst. Meereskunde, Univ. Kiel, West Germany] The capability of roach (/Rutilus rutilus/ L.) to reproduce in brackwater was examined by means of artificial propagation and field investigations in the "Schlei", a baltic fjord of northern Germany. Fertilisation success was not affected in the salinities tested (1.8-10.2 °/oo salinity). The rate of water uptake into the eggs was slowed down in salinities of 3.5 °/oo salinity and higher, while the final amount of water taken up in each of these salinities exceeded that of the freshwater control. Egg-shells burst in these salinities long before normal hatching took place in freshwater. Normally built embryos dropped out

80-000407 CONTINUED
of their shells. The mortality of these embryos increased with salinity. From 8.6 °/oo S upwards a total pregastrulation mortality occurred. For eggs and porlarvae salinities which limited longterm survival lay between 1.8 and 3.5 °/oo salinity. Juveniles could withstand salniities up to 11.5 to 12.7 °/oo. A temperature of 9.6 °C, which was tested up to first food intake, increased the negative influences of salinity in camparison to 14.6 °C. Field investigations upon the occurrence of roach-fry, conducted with a fish-fry beachseine, showed that in the "Schlei" spawning of roach takes place in freshwater sites only.

80-000408 Shikhshabekov, M. M. THE SEXUAL CYCLES OF THE CATFISH, /SILURUS GLANIS/, THE PIKE, /ESOX LUCIUS/, THE PERCH, /PERCA FLUVIATILIS/, AND THE PIKE-PERCH, /LUCIOPERCA LUCIOPERCA/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 457-468. 1978. SFA 25(1)
[Dagestan Agric. Inst., Makhock-Kala, USSR]

80-000409 Spanovskaya, V. D.; Grigorash, V. A. THE REPRODUCTIVE CAPACITY OF /CYCLOTHONE BRAUERI/ IN THE SOUTHERN PART OF THE PACIFIC OCEAN. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 504-508. 1978. SFA 25(1)
[Dep. Ichthyol., Moscow Univ., USSR] Sexual dimorphism (females larger than males), intermittent spawning, increase in fecundity with linear growth are characteristic of /C. brauerí/. The beginning of spawning in the southern part of the Fiji Basin occurs in the first half of January. Females in the spawning population are qualitatively different as regards generative metabolism: this is an adaptation characteristic of the dynamics of abundance of the species in question.--concl.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

80-000410 Casterlin, M. E.; Reynolds, W. W. DIEL ACTIVITY PATTERNS OF THE SMOOTH DOGFISH SHARK, /MUSTELUS CANIS/. Bull. Mar. Sci. 29 (3): 440-442. July 1979. SFA 25(1)
[Biol. Dep., Pa. State Univ., Wilke-Barre 18708] Fourteen smooth dogfish sharks, /Mustelus canis/, collected from bays in Stone Harbor, New Jersey, (12°C, 30 °/oo salinity) were tested individually in an electronic shuttlebox to determine their diel activity patterns. Activity was quantified as interruptions of photocell-monitored light beams as the sharks shuttled between chambers of the device. The sharks were tested under an artifical photoperiod of 8 h photophase, 4 h dusk, 8 h scotophase and 4 h dawn. The sharks exhibited a primarily nocturnal activity pattern, with 45 percent of their total 24-h activity occurring during scotophase, 32 percent during the crepuscular transitions, and 23 percent during photophase. Activity levels increased steadily after onset of scotophase, reaching a peak between 0100 and 0400, and began to decrease prior to onset of "dawn". Nocturnal activity in /M. canis/ may be related to the fact that its crustacean prey are also nocturnal.

80-000411 Dooley, H. D.; McKay, D. W. THE DRIFT OF HERRING LARVAE FROM THE WEST COAST TO THE NORTH SEA. Scott. Fish. Bull. 45: 10-12. 1979. SFA 25(1)

80-000412 Holliday, D. V.; Larsen, H. L. THICKNESS AND DEPTH DISTRIBUTIONS OF SOME EPIPELAGIC FISH SCHOOLS OFF SOUTHERN CALIFORNIA. NOAA Fish. Bull. 77 (2): 489-494. Apr. 1979. SFA 25(1)
[Tracor, Inc., San Diego Lab., 3420 Kenyon St., San Diego, CA 92110] The thickness and vertical distributions of shallow schools of many fish cannot be accurately measured by conventional echo sounding techniques. Consequently, a new approach which makes use of the bottom bounce acoustic propagation path has been developed and used for measurements on northern anchovy schools off southern California. These measurements, at three locations in three different seasons, revealed that the schools occupied a depth zone only a few meters thick. Good agreement was found between occurrence of the mean depths of the schools and the seasonal thermocline, where it is hypothesized that thermal stratification, and associated water density microstructure may lead to an aggregation of some part of the fishes' food supply in thin layers.--Concl.

80-000413 Jellyman, D. J. UPSTREAM MIGRATION OF GLASS-EELS (/ANGUILLA/ SPP.) IN THE WAIKATO RIVER. N.Z. J. Mar. Freshwater Res. 13 (1): 13-22. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand]

80-000414 Robins, C. R.; Cohen, D. M.; Robins, C. H. THE EELS, /ANGUILLA/ AND /HISTIOBRANCHUS/, PHOTOGRAPHED ON THE FLOOR OF THE DEEP ATLANTIC IN THE BAHAMAS. Bull. Mar. Sci. 29 (3): 401-405. July 1979. SFA 25(1)
[Rosenstiel Sch. Mar. Atmos. Sci., 4600 Rickenbacker Causeway, Miami, FL 33149] The first record of an adult eel of the genus /Anguilla/ in the deep sea is reported from nearly 2,000 meters on the bottom of Tongue-of-the-Ocean, Bahamas. The record is based on photographs taken from the submersible ALVIN. Whether it represents /Anguilla anguilla/ or /Anguilla rostrata/ cannot be determined. The basis of the identification is discussed and comments are provided on other eels of the region especially /Histiobranchus/, a synaphobranchid eel also photographed in Tongue-of-the-Ocean. Comments are provided concerning the significance of this discovery to our knowledge of the distribution and biology of /Anguilla/.

FOODS AND FEEDING

80-000415 Adalsteinsson, H. SIZE AND FOOD OF ARCTIC CHAR /SALVELINUS APLINUS/ AND STICKLEBACK /GASTEROSTEUS ACULEATUS/ IN LAKE MYVATN. Oikos 32 (1/2): 228-231. 1979. In English with Russian summ. SFA 25(1)
[Natl. Energy Auth., Laugaveg 116, Rekjavik, Iceland] The fish community in the lake is described. The age structure of char has changed since 1933 when 7-yr specimens were common. Today individuals older than 5 yr are scarce. The growth rate of 7-8 cm yr^{-1} was the same in 1933 and 1972-73. Only old large female sticklebacks were netted, probably because males are too small. Food was more abundant and diverse in the S- than in the N-basin. In the S-basin the food choice of the char was determined by peaks of the food organisms: in

80-000415 CONTINUED
spring mostly chironomid pupae, during summer benthic crustaceans, mainly /Lepidurus arcticus/ (Pallas) and /Eurycercus lamellatus/ (Muller), and in autumn zooplankton (/Daphnia longispina/ (Muller)). The proportion of chironomid larvae was always considerable. Sticklebacks and /Radix peregra/ were taken when above food items were scarce. Food important in the S-basin was scarce in the N-basin, where sticklebacks and /R. peregra/ were dominant food of the char, representing a case of constrained feeding behaviour. The choice of food varied little with the size of the char (greater than 10 cm). Sticklebacks fed overwhelmingly on benthos, mainly chironomid larvae, /E. lamellatus/ and /Cyclops/. in the N-basin, sticklebacks took /R. peregra/, their own eggs and undigestible trash much more commonly than elsewhere.

80-000416 Balirwa, J. S. A CONTRIBUTION TO THE STUDY OF THE FOOD OF SIX CYPRINID FISHES IN THREE AREAS OF THE LAKE VICTORIA BASIN, EAST AFRICA. Hydrobiologia 66 (1): 65-72. 15 Sept. 1979. SFA 25(1)
[EAFFRO, Jinja, P.O. Box 343, Jinga, Uganda] An account of the food of six species of cyprinid fish from the Lake Victoria basin is given. All the species studied possess tubular stomachs and analysis was carried out on entire guts, the relative importance of the various dietary items being assessed by the frequency occurrence method. Results indicate that these species are omnivorous, and their food ranges from debris, diatoms through algae, insect larvae to molluscs. Comparison of the food of /Barbus/ spp. from the lake and river shows that riverine fish ingest more plant material than lake fish.

80-000417 Blaber, S. J. M. THE BIOLOGY OF FILTER FEEDING TELEOSTS IN LAKE ST LUCIA, ZULULAND. J. Fish Biol. 15 (1): 37-59. July 1979. SFA 25(1)
[Zool. Dep., Univ. Natal, Pietermaritzburg, Natal, South Africa] The biology of filter feeding teleosts in St Lucia, was studied for two years from 1976 to 1978. The three common species, /Gilchristella aestuarius/, /Hilsa kelee/ and /Thryssa vitrirostris/ were studied with the composition and cyclical nature of the zooplankton which formed their food. There was a close correlation between the zooplankton cycles, both diel and annual, and the feeding, reproduction and recruitment of the three common filter feeding teleosts. /G. aestuarius/ spent its whole life-cycle in the system and spawned in early summer when the resulting juveniles could feed on the summer zooplankton peaks. They grew at 0.5 cm $month^{-1}$ and attained maximum size in one year. They were non-selective taking mainly /P. stuhlmanni/ and post-veligers. /H. kelee/ spawned in the sea and juveniles were common in St Lucia during 1978 when they fed non-selectively, chiefly on /P. stuhlmanni/ but also on phytoplankton. Adult /T. vitrirostris/ entered St Lucia in late winter and spawned during the summer before disappearing over the winter. The resulting offspring went through a sequence of dietary changes which were closely related to zooplankton cycles. The importance of /P. stuhlmanni/ in the pelagic food web of St Lucia is illustrated. The species supports not only the filter feeding teleosts but indirectly the predatory fish /Argyrosomus hololepidotus/ and /Elops machnata/ which feed on /G. aestuarius/ and /t. vitrirostris/.--From abstr.

80-000418 Brambilla, D. J. LIFE HISTORIES AND SIZE-SELECTIVE PREDATION IN /DAPHNIA PULEX/. Ph.D. dissertation, Univ. Mich. 211p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5):2029. Nov. 1979. SFA 25(1)

80-000419 Chan, E. H.; Chua, T. E. THE FOOD AND FEEDING HABITS OF GREENBACK GREY MULLET, /LIZA SUBVIRIDIS/ (VALENCIENNES), FROM DIFFERENT HABITATS AND AT VARIOUS STAGES OF GROWTH. J. Fish Biol. 15 (2): 165-171. Aug. 1979. SFA 25(1)
[Fac. Fish. Mar. Sci., Univ. Agric. Malaysia, Serdang, Selangor, Malaysia] An analysis of the stomach contents of /Liza subviridis/ at various stages of growth and from different habitat types is given. Transitions in diet with respect to size were observed. Postlarval stages of less than 12 mm standard length fed only on zooplankton. The transition to bottom feeding occurred in specimens 16-20 mm, with food items consisting of zooplankton, diatoms, detrital material and inorganic sediment. The transition was complete on attaining a length of 24 mm whereby food items comprised diatoms, detrital material, filamentous algae and inorganic sediment. The relevance of this information in aquaculture is discussed. The stomach contents of adult /Liza subviridis/ taken from different habitat types were consistent, comprising diatoms, detrital material and inorganic sediment. Filamentous algae was also consumed where available.

80-000420 Diggins, M. F.; Summerfelt, R. C.; Mnich, M. A. ALTERED FEEDING ELECTIVITY OF THE BLUEGILL FROM INCREASED PREY ACCESSIBILITY FOLLOWING MACROPHYTE REMOVAL. Proc. Okla. Acad. Sci. 59: 4-11. 1979. SFA 25(1)
[Dep. Biol., Mt. Mary Coll., Yankton, SD 57078] Species diversity and biomass of invertebrates in stomachs of young-of-the-year, 1- and 2-year-old bluegill (/Lepomis macrochirus/) were examined in relation to variation in the benthos of a pond treated with a herbicide. Vascular plant biomass, mainly /Potamogeton/ spp, were nearly eliminated by the treatment; at the 0-1 m depth stratum, the biomass dropped from 481.2 g dry weight per m^2 to 0.3 g dry weight per m^2. Density of the phytomacrofauna declined but the abundance of detritivorous invertebrates increased in post-treatment collections. Averages of total numbers and biomass of zooplanktonic and benthic organisms in stomachs were larger in the sampling period following treatment. Species diversity (d) of macroinvertebrates in the fish stomachs increased following the herbicide application even though the diversity of macroinvertebrates in the environment declined. Species diversity of the total food ration, including the zooplankton, diminished following treatment because of predator electivity for only the cladoceran species in the zooplankton. The authors suggest that both prey density and vulnerability are of importance in predator selection and that a preferred species, if vulnerable, may be selected even when not relatively abundant.

80-000421 Elshoud-Oldenhave, M. J. W. PREY CAPTURE IN THE PIKE-PERCH, /STIZOSTEDION LUCIOPERCA/ (TELEOSTEI, PERCIDAE): A STRUCTURAL AND FUNCTIONAL ANALYSIS. Zoomorphologie 93 (1): 1-32. 1979. SFA 25(1)
[Zool. Lab., Univ. Leiden, Kaiserstraat 63 2300, RA Leiden, The Netherlands]

80-000422 Eriksson, M. O. G. COMPETITION BETWEEN FRESHWATER FISH AND GOLDENEYES /BUCEPHALA CLANGULA/ (L.) FOR COMMON PREY. Oecologia (Berl.) 41 (1): 99-107. July 1979. SFA 25(1)
[Dep. Zool., Univ. Goteborg, Pack, S-400 33 Goteborg, Sweden] Results of a descriptive field study showed that goldeneyes preferred lakes without fish to those with fish. Field experiments were carried out in order to investigate whether or not this preference could be ascribed to a higher food supply in the lakes devoid of fish, as goldeneyes and some freshwater fish (perch and roach in the studied lakes) to some extent feed on the same kinds of prey. Changes in the abundance of prey common to fish and goldeneyes and the use by goldeneyes of lakes after experimentally changed predation pressure from fish were studied. Some aquatic insect groups, /Cloeon/ larvae, Odonata larvae, water bugs, dytiscids, and /Chaoborus/ larvae, proved sensitive to predation from fish. Goldeneyes increased their use of an experimental lake after fish were removed, and they used this lake more than an adjacent control lake. It is suggested that fish are able to reduce the availability of foods common to the goldeneyes to such an extent that the selection by the ducks of feeding localities is affected, and that exploitation competition between freshwater fish and goldeneyes may occur.

80-000423 Gorelova, T. A. THE FEEDING OF LANTERNFISHES, /CERATOSCOPELUS WARMINGI/ AND /BOLINICHTHYS LONGIPES/, OF THE FAMILY MYCTOPHIDAE IN THE WESTERN EQUATORIAL PART OF THE PACIFIC OCEAN. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 588-598. 1978. SFA 25(1)
[Inst. Oceanol., USSR Acad. Sci., Moscow, USSR] The feeding of young and adult specimens of /Ceratoscopelus warmingi/ and /Bolinichthys longipes/ was investigated. Copepoda are the main food items of /B. longipes/; /C. warmingi/ Amphipoda and Euphausiacea are also frequently encountered. Interzonal species of these groups of crustaceans predominate in the stomachs of mesopelagic myctophids. The reasons for the differences in the food spectra of mesopelagic and "near-surface" myctophids are discussed.

80-000424 Gowing, H.; Mosot, W. T. IMPACT OF BROOK TROUT (/SALVELINUS FONTINALIS/) PREDATION ON THE CRAYFISH /ORCONECTES VIRILIS/ IN THREE MICHIGAN LAKES. J. Fish. Res. Board Can. 36 (10): 1191-1196. Oct. 1979. In English with French summ. SFA 25(1)
[Mich. Dep. Nat. Resour., Lewiston 49756]

80-000425 Haldorson, L.; Moser, M. GEOGRAPHIC PATTERNS OF PREY UTILIZATION IN TWO SPECIES OF SURFPERCH (EMBIOTOCIDAE). Copeia 1979 (4): 567-572. 28 Nov. 1979. SFA 25(1)
[Dep. Biol. Sci,. Univ. Calif., Santa Barbara 93106] The diets of the pile surfperch (/Damalichthys vacca/) and the striped surfperch (/Embiotoca lateralis/) were examined in seven locations from Puget Sound to Santo Tomas, Baja California, Mexico. The pile surfperch specializes in hard-shelled molluscs, crabs and barnacles, whereas the striped surfperch consistently eats amphipods and bryozoans. Although stiped surfperch utilize a wide range of prey items throughout most of their range, a population adjacent to a gap in distribution utilizes a low diversity of prey items. A reduction in mouth size is associated with the diet restriction observed in the striped surfperch, suggesting that a localized adaptive specialization to a restricted food niche has occurred in marginal populations of that species.

80-000426 Hall, D. J.; Werner, E. E.; Gilliam, J. F.; Mittelbach, G. G.; Howard, D.; Doner, C. G.; Dickerman, J. A.; Stewart, A. J. DIEL FORAGING BEHAVIOR AND PREY SELECTION IN THE GOLDEN SHINER (/NOTEMIGONUS CRYSOLEUCAS/). J. Fish. Res. Board Can. 36 (9): 1029-1039. Sept. 1979. In English with French summ. SPA 25(1)
[Dep. Zool., Mich. State Univ., Hickory Corners, MI 49060]

80-000427 Johnson, J. H.; Bingler, W. H. THE OCCURRENCE OF BLOW FLY LARVAE (DIPTERA: CALLIPHORIDAE) ON SALMON CARCASSES AND THEIR UTILIZATION AS FOOD BY JUVENILE SALMON AND TROUT. Great Lakes Entomol. 12 (3): 137-140. 1979. SPA 25(1)
[N.Y. Dep. Environ. Conserv., 50 Wolf Rd., Albany 12233]

80-000428 Johnson, J. H.; Bingler, W. H. PREDATION ON PACIFIC SALMON EGGS BY SALMONIDS IN A TRIBUTARY OF LAKE ONTARIO. J. Great Lakes Res. 5 (2): 177-181. 1979. SPA 25(1)
[N.Y. State Dep. Environ. Conserv., 50 Wolf Rd., Albany 12233]
Diets of salmonids in a tributary of Lake Ontario were examined during the fall of 1977. Pacific salmon eggs accounted for at least 90 percent of the October diet of juvenile steelhead and coho salmon, and adult brook trout and brown trout. In November, salmon eggs comprised 38-95 percent of the diet. Egg consumption appeared to be responsible for large increases in the condition factor of all groups studied. Increased condition may enhance survival during the severe winters charactgeristic of the Tug Hill region.

80-000429 Jones, R. FOOD CHAINS AND OUR FISH SUPPLY. Scott. Fish. Bull. 45: 4-10. 1979. SPA 25(1)

80-000430 Kamlyuk, L. V.; Lyakhnovich, V. P.; Kopylova, T. V. EFFECTIVENESS OF ZOOPLANKTON UTILIZATION IN CARP FORAGING PONDS. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 665-669. 1978. SPA 25(1)
[Bel NIIRKh, Minsk, USSR] The degree of utilization of zooplankton in foraging ponds with a differing stocking density of carp, /Cyprinus carpio/, and different levels of intensification is assessed. The amount of zooplankton eaten by two-year old carp during the growing season amounted to 25-47 percent of the total production of zooplankton or 3.0-4.5 percent of the biomass per day. Utilization of zooplankton production accounted for 8-49 percent of the total increase in fish production at food coefficients of zooplankton between 9.3 and 13.4.

80-000431 Hinch, J. C. TROPHIC HABITS OF THE JUVENILE FISHES WITHIN ARTIFICIAL WATERWAYS--MARCO ISLAND, FLORIDA. Contrib. Mar. Sci. 22: 77-90. Aug. 1979. SPA 25(1)
[United Engineers & Constructors, Inc., 100 Summer St., Boston, MA 02110] The present investigation was directed toward describing the trophic habits and factors which affect the distribution of juvenile fishes in a dredged residential canal of a Southwest Florida ocean-front development. The data presented provide a quantitative examination of both the spatial and temporal aspects of the more abundant species. A strong similarity was found between the trophic habits of fishes within the canals and published data for fishes of identical age classes from natural areas.

80-000432 Konchina, Yu. V. SOME DATA ON THE FEEDING OF THE PERUVIAN JACK MACKEREL, /TRACHURUS SYMMETRICUS MURPHYI/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (4): 687-690. 1978. SFA 25(1)
[VNIRO, Moscow, USSR] As regards the nature of the food, the Peruvian jack mackerel is a zoophage. The adult jack mackerel feeds on planktonic crustaceans. As regards the number of species, Copepoda and the larvae of Decapoda are the most diversely represented in the feeding spectrum of the jack mackerel. Euphausiacea, young Stomatopoda and the larvae of Decapoda are the main food items of the Peruvian jack mackerel. Fish occupied a considerable place in the food of large fish 52-58 cm long. The species composition of the food changed by month and in different parts of its range.--Concl.

80-000433 Libey, G. S.; Cole, C. F. FOOD HABITS OF YELLOWTAIL FLOUNDER, /LIMANDA FERRUGINEA/ (STORER). J. Fish Biol. 15 (3): 371-374. Sept. 1979. SFA 25(1)
[Dep. For. Nat. Resour., Purdue Univ., West Lafayette, IN 47907] Yellowtail flounder, /Limanda ferruginea/ were collected from the waters north of Cape Ann, Massachusetts, from April 1971 to January 1972. Cumaceans were the most important food item in the spring. Amphipods and polychaetes, as well as cumaceans, were the main foods consumed in other seasons. Large volumes of plant detritus, sand, and pebbles were present in the stomachs throughout the year. The highest percentage of empty stomachs coincided temporally with the spawning season, although the frequency of occurrence was low at all times. There were no differential food habits by sex or age.

80-000434 Maret, T. R.; Peters, E. J. FOOD HABITS OF THE WHITE CRAPPIE, /POMOXIS ANNULARIS/ RAFINESQUE, IN BRANCHED OAK LAKE, NEBRASKA. Trans. Nebr. Acad. Sci. Affl. Soc. 7: 75-82. 1979. SFA 25(1)
[Dep. For. Fish. Wildl., Univ. Nebr., Lincoln 68583] Food habits of adult white crappie, /Pomoxis annularis/ Rafinesque, in Branched Oak Lake, Lancaster County, Nebraska, were studied by examination of stomach contents from 170 fish. Specimens ranging in size from 194-330 mm were collected by creel census and electrofishing between April 17 and May 5, 1977. Collections were confined to the area along the dam to determine whether crappie prey on newly-hatched walleye larvae. Stomach contents were separated to the lowest feasible taxonomic category, counted, and weighed. Analyses showed that at least 17 taxa were eaten by the crappie. /Hexagenia/ sp. was found to be the most important food item. It occurred in nearly 70 percent of all stomachs containing food and made up 48 percent of the total diet by weight. Fish were found in nearly 32 percent of all stomachs containing food and made up 31 percent of the total diet by weight. However, no larval fish were found. Other important food items consumed were Hirudinea, Chironomidae, Chaoboridae, and Amphipoda.

80-000435 Mathur, D.; Robbins, T. W. FOOD OF THE WHITE CRAPPIE, /POMOXIS ANNULARIS/ RAFINESQUE, IN TWO NEW IMPOUNDMENTS. Proc. Pa. Acad. Sci. 53 (1): 34-36. 1979. SFA 25(1)
[RMC-Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518] Striking differences in the diet of the white crappie, /Pomoxis annularis/, were noted in two new impoundments in Pennsylvania. In Muddy Run Recreation Lake, the diet progressively changed from planktonic crustaceans to fishes. In the Muddy Run Pumped Storage Pond a feature was extension of the planktonic feeding phase; little fish matter was consumed. Immature forms of insects were only of minor importance on a volumetric basis although they were frequently eaten.

80-000436 Mito, K. [FOOD RELATIONSHIPS IN THE DEMERSAL FISH COMMUNITY IN THE BERING SEA. II. LENGTH COMPOSITIONS OF FISH SPECIES.] Bull. Fac. Fish. Hokkaido Univ. 30 (2): 144-162. May 1979. In Japanese with English summ. SFA 25(1)
[Res. Inst. North Pac. Fish., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-000437 Naiman, R. J. PRELIMINARY FOOD STUDIES OF /CYPRINODON MACULARIUS/ AND /CYPRINODON NEVADENSIS/ (CYPRINODONTIDAE). Southwest. Nat. 24 (3): 538-541. 15 Sept. 1979. SFA 25(1)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

80-000438 Neudecker, S. EFFECTS OF GRAZING AND BROWSING FISHES ON THE ZONATION OF CORALS IN GUAM. Ecology 60 (4): 666-672. Aug. 1979. SFA 25(1)
[Inst. Ecol., Div. Environ. Stud., Univ. Calif., Davis 95616]

80-000439 Pearson, W. D.; Thomas, G. A.; Clark, A. L. EARLY PISCIVORY AND TIMING OF THE CRITICAL PERIOD IN POSTLARVAL LONGNOSE GAR AT MILE 571 OF THE OHIO RIVER. Trans. Ky. Acad. Sci. 40 (3/4): 122-128. Sept. 1979. SFA 25(1)
[Water Resour. Lab., Univ. Louisville, Louisville, KY 40208]
Postlarval longnose gar /Lepisosteus osseus/ of 14.1-42.5 mm total length were collected at Ohio River Mile 571 in Trimble County, Kentucky, in May and June of 1977 and 1978. In 1977, only 13.3 percent of those gar with food in their stomachs had consumed other fishes, while cladocerans were the dominant items in the diet. In 1978, however, larval fishes were found in the guts of 84.1 percent of the gar that contained some food. Gar smaller than 20 mm total length contained no food. Apparently, the "critical period" in which postlarval gar must switch over to exogenous foods ends at a body length of 25 to 26 mm when the fish are estimated to be 18 days old.

80-000440 Powell, A. B.; Schwartz, F. J. FOOD OF /PARALICHTHYS DENTATUS/ AND /P. LETHOSTIGMA/ (PISCES: BOTHIDAE) IN NORTH CAROLINA ESTUARIES. Estuaries 2 (4): 276-279. Dec. 1979. SFA 25(1)
[Beaufort Lab., Southeast Fish. Cent., NMFS, Beaufort, NC 28516]
The diets of the spatially segregated summer flounder, /Paralichthys dentatus/, and southern flounder, /P. lethostigma/, in Pamlico Sound, North Carolina, were composed of crustaceans and fishes. Young flounders fed mainly on mysids and fishes throughout the year, but the ratios of these items differed between species. Feeding was minimal during winter, but summer flounder from near-inlet stations had a high frequency of stomachs with food. Older summer flounder fed equally on shrimp and fishes, while southern flounder fed almost solely on fishes. This difference was probably related to food availability.

80-000441 Proskurina, Ye. S. THE FEEDING OF YOUNG FISH IN THE ARAL SEA. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 417-423. 1978. SFA 25(1)
[Aral Dep., Kazakh Fish. Res. Inst., USSR] As a result of alterations in the food supply of the Aral Sea changes have occurred in the feeding of commercial fishes, in particular their changeover to the consumption of introduced organisms (Polychaeta, Mysidaecea) the biomass of which is fairly high (6-11 g/m^2).

80-000442 Sagua, V. O. OBSERVATIONS ON THE FOOD AND FEEDING HABITS OF THE AFRICAN ELECTRIC CATFISH /MALAPTERURUS ELECTRICUS/ (GMELIN). J. Fish Biol. 15 (1): 61-69. July 1979. SFA 25(1)
[Agric. Sci. Dep. N.S.T.D.A., Ibadan, Nigeria] The diet and feeding habits of the African electric catfish /Malapterurus electricus/ in their natural habitat in Lake Kainji, and in the River Niger, downstream of Kainji dam, Nigeria, have been described and compared. The study showed the electric catfish is a voracious piscivore. It feeds on cichlids, clupeids, schilbeids and other available fish species. From the size distribution, numbers and composition of the small prey fish species examined in electric catfish stomachs, it was inferred that the powerful high-frequency electric organ discharge volleys serve as major predatory mechanism.

80-000443 Sirotenko, M. D.; Istomin, A. I. SEASONAL CHANGES IN THE FOOD OF THE "BLACK SEA SCAD", /TRACHURUS MEDITERRANEUS PONTICUS/. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 424-431. 1978. SFA 25(1)
[AzCherNIRO, Kerch, USSR] The feeding intensity and food selectivity of the Black Sea scad, /Trachurus mediterraneus ponticus/, was studied in certain regions of the Black Sea at different times of the day. Maximum feeding intensity occurs in summer, minimum feeding intensity in winter. In spring Copepoda predominate in the food and fish in summer. The nature of the feeding is closely related to the distribution of food organisms.

80-000444 Sosiak, A. J.; Randall, R. G.; McKenzie, J. A. FEEDING BY HATCHERY-REARED AND WILD ATLANTIC SALMON (/SALMO SALAR/) PARR IN STREAMS. J. Fish. Res. Board Can. 36 (11): 1408-1412. Nov. 1979. In English with French summ. SFA 25(1)
[Montreal Engineering Co. Ltd., Environ. Div., 593 King St., Fredericton, NB E3B 1E8, Canada]

80-000445 Strauss, R. E. RELIABILITY ESTIMATES FOR IVLEV'S ELECTIVITY INDEX, THE FORAGE RATIO, AND A PROPOSED LINEAR INDEX OF FOOD SELECTION. Trans. Am. Fish. Soc. 108 (4): 344-352. July 1979. SFA 25(1)
[Grad. Ecol. Prog., Pa. State Univ., University Park 16802]

80-000446 Vinyard, G. AN OSTRACOD (/CYPRIODOPSIS VIDUA/) CAN REDUCE PREDATION FROM FISH BY RESISTING DIGESTION. Am. Midl. Nat. 102 (1): 188-190. July 1979. SFA 25(1)
[Dep. Biol., Univ. Nev., Reno 89557] /Cypriodopsis vidua/, a small ostracod common in temperate North American lakes, has substantial abilities to resist the digestive processes of small bluegill sunfish. Of the ostracods ingested in these experiments, 26 percent traversed the gut of the fish apparently unharmed. Such resistance to digestion constitutes a mechanism of escaping predation and may be relevant in considerations of prey choice by predators. Resistance to digestion could moderate the effects of predation on ostracod populations and could also foster dispersal.

80-000447 Wattendorf, R. J. CANNIBALISM IN ELVERS. Prog. Fish-Cult. 47 (4): 218. Oct. 1979. SFA 25(1)
[Fla. Game Fresh Water Fish Comm., 800 N.W. 40th St., Boca Raton 33431]

80-000448 Weir, D. N. BROWN TROUT AMONG FOOD REMAINS IN A PEREGRINE'S NEST. Bird Study 26 (3): 200. Sept. 1979. SFA 25(1)
[Creagdhu, Newtonmore, Inverness-shire, Scotland]

80-000449 Went, A. E. J. 'FEROX' TROUT, /SALMO TRUTTA/ L. OF LOUGHS MASK AND CORRIB. J. Fish Biol. 15 (3): 255-262. Sept. 1979. SFA 25(1)
[46 Castlepark Rd., Sandycove, Co. Dublin, Ireland] Sets of scales with the relevant information were collected by the Irish Specimen Fish Committee from large or specimen brown trout taken by angling from Loughs Mask, and Corrib. The relationship between lengths and age were determined for those fish for which the necessary information was available. It was concluded that those fish destined to become specimens (10 lb or over in weight) had adopted a fish-eating habit to enable them to maintain a high rate of growth.

AGE AND GROWTH

80-000450 Abbasov, G. S.; Polyakov, G. D. EVALUATION OF FEEDING CONDITIONS AND THE BIOLOGICAL STATE OF A FISH POPULATION BY MEANS OF THE CONDITION FACTOR. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 404-417. 1978. SFA 25(1)
[Zool. Inst. Azerbaydzhan Acad. Sci., Baku, USSR] using young fish in Azerbaydzhan as an example, it is shown to what extent and under what conditions the condition factor can be used as an indicator of the physiological state. In order that age-induced morphological changes should not influence evaluation of the condition factor, it is proposed to use this factor, calculated not by the usual formula, but on the basis of the "initial size" of the young fish.

80-000451 Barans, C. A.; Stender, B. W.; Nichy, F. OTOLITH REMOVAL FROM MARKETABLE FISH. Prog. Fish-Cult. 47 (4): 212-213. Oct. 1979. SFA 25(1)
[Mar. Resour. Res. Inst., S.C. Wildl. Mar. Resour. Dep., Charleston 29412]

80-000452 Beamish, R. J. NEW INFORMATION ON THE LONGEVITY OF PACIFIC OCEAN PERCH (/SEBASTES ALUTUS/). J. Fish. Res. Board Can. 36 (11): 1395-1400. Nov. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-000453 Beitinger, T. L.; Magnuson, J. J. GROWTH RATES AND TEMPERATURE SELECTION OF BLUEGILL, /LEPOMIS MACROCHIRUS/. Trans. Am. Fish. Soc. 108 (4): 378-382. July 1979. SFA 25(1)
[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

80-000454 Beyer, J. E.; Laurence, G. C. A STOCHASTIC MODEL OF LARVAL FISH GROWTH. Ecol. Model. 8: 109-132. Jan. 1980. SFA 25(1)
[Danish. Inst. Fish. Mar. Res., Charlottenlund Slot, DK-2920, Charlottenlund, Denmark]

80-000455 Brenner, B. C. ULTRASONIC METHOD FOR CLEANING FISH SCALES FOR AGING. Prog. Fish-Cult. 41 (3): 144. July 1979. SFA 25(1)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ,. College Station 77843]

80-000456 Burrough, R. J.; Kennedy, C. R. THE OCCURRENCE AND NATURAL ALLEVIATION OF STUNTING IN A POPULATION OF ROACH, /RUTILUS RUTILUS/ (L.). J. Fish Biol. 15 (1): 93-109. July 1979. SFA 25(1)
[Imperial Coll. Cent. Environ. Technol., 48 Princes Gardens, London SW7 2AZ, England] Two sudden and pronounced changes in the growth rate of raoch, /Rutilus rutilus/ (L.), in Slapton Ley, Devon, have been observed between 1972 and 1976. At first the growth rate declined to the point at which the population became stunted, then subsequently it improved again. These changes were correlated with population density; the numbers of roach were increasing during the late 1960's/early 1970's, and this increase was substantially reinforced by very strong year classes in 1972, and, to a lesser extent, in 1973. The increase in population density resulting from the strong 1972 year class was apparently adequate to accelerate the onset of the stunting observed. The improvement in growth rate in 1976 followed immediately after extensive mortalities amongst the roach during 1975, caused by an epidemic of the parasite /Ligula intestinalis/ (L.). Some improvement in the growth of 0 group roach had been evident during 1975, but this was not observed in the populations. Ford-Walford plots showed a decline in the value of L infinity after the onset of stunting in 1972. Differences in the reproductive biology of the fish were found following the alleviation of stunting; the gonads of both sexes achieved a greater relative weight, and correspondingly the fecundity of the females was higher, although this latter effect became progressively less marked with increasing size. It was not apparent amongst the largest individuals. There was also some evidence of a decline in the proportion of fish maturing at minimum size. The changes in the reproductive biology were associated with the improvement in conditions for individual fish following the decline in population density.

80-000457 Eckmayer, W. J. AGE AND GROWTH OF FOUR SURFPERCHES (EMBIOTOCIDAE) FROM THE OUTER HARBOR OF ANAHEIM BAY, CALIFORNIA. Calif. Fish Game 65 (4): 265-272. Oct. 1979. SFA 25(1)
[Ala. Mar. Resour. Lab., Dauphin Island] Age and growth data were collected and analyzed for four species of surfperches, /Cymatogaster aggregata/, /Embiotoca jacksoni/, /Hyperprosopon argenteum/, and /Phanerodon furcatus/. Standard length to total length, scale radius to standard length, and otolith radius to standard length relationships were constant for all four species, thus allowing for back calculating the ages. Slopes of the length-weight relationship for the four species were all approximately 3.0, indicating isometric growth.

80-000458 Fouda, M. M.; Miller, P. J. ALKALINE PHOSPHATASE ACTIVITY IN THE SKIN OF THE COMMON GOBY, /POMATOSCHISTUS MICROPS/ (KROYER), IN RELATION TO CYCLES IN SCALE AND BODY GROWTH. J. Fish Biol. 15 (3): 263-273. Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Bristol, Bristol, England] A histochemical study of the distribution of alkaline phosphatase in the skin of the Common Goby, /Pomatoschistus microps/, showed that the enzyme is present in the dermis, not in the epithelium, and is more pronounced around the growing edge of the scale and below the fibrillary plate. The intensity of the enzyme reaction is higher in regenerated scales. In conjunction with the phenology of /P. microps/, a method was adopted to measure the enzyme activity in the skin, including scales, for successive months over a period of two years. Enzyme activity displayed seasonal fluctuations which were closely related to both body and scale growth. Enzyme activity also reflected other phenological cycles during the life-span of /P. microps/.

80-000459 Harrison, E. J.; Hadley, W. F. A COMPARISON OF THE USE OF CLEITHRA TO THE USE OF SCALES FOR AGE AND GROWTH STUDIES. Trans. Am. Fish. Soc. 108 (5): 452-456. Sept. 1979. SFA 25(1)
[Dep. Biol. Pesq., Fund. LaSalle, Isla de Margarita, Venequela]

80-000460 Hopkins, C. L. AGE-RELATED GROWTH CHARACTERISTICS OF /GALAXIAS FASCIATUS/ (SALMONIFORMES: GALAXIIDAE). N.Z. J. Mar. Freshwater Res. 13 (1): 39-46. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] /Galaxias fasciatus/ Gray is one of the diadromous glaxiids whose juveniles are known in New Zealand as whitebait. Its otoliths are shown to have a regular pattern of summer and winter zones that can be used for age determination. Age and annual growth were examined in specimens from the South Island and from the Owhiro Stream, Wellington. A form of the von Bertalanffy growth equation was used to fit curves to the observed data. Body lengths ranged from 4 cm in juveniles just entering fresh water to nearly 25 cm in the largest adults. Females were found to grow faster and to reach a greater size than males. The oldest fish successfully aged was in its tenth year. About 21 percent of fish from Banks Peninsula exceeded age 5, but only 7 percent from Owhiro Stream were older than this.

80-000461 Jellyman, D. J. SCALE DEVELOPMENT AND AGE DETERMINATION IN NEW ZEALAND FRESHWATER EELS (/ANGUILLA/ SPP.). N.Z. J. Mar. Freshwater Res. 13 (1): 23-30. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] The appearance and development of scales in /Anguilla australis/ Richardson and /A. dieffenbachii/ Gray were studied to assess the value of scales in age determination. Scales first appear in an area two-thirds along the anus-tail tip distance, when eels are 16-20 cm long. The rate of lateral and longitudinal scale spreading, scale size, and the number of scale rings were all positively related to fish length. The formation of new scale rings showed no seasonal pattern, so these rings cannot be used for age determination. Age could not be determined from length-frequency histograms owing to overlapping of data from adjacent year-classes. However, examination of otoliths prepared by burning showed that the otolith rings were annual in formation, and could be satisfactorily used to calculate age.

80-000462 Linfield, R. S. J. CHANGES IN THE RATE OF GROWTH IN A STUNTED ROACH /RUTILUS RUTILUS/ POPULATION. J. Fish Biol. 15 (3): 275-298. Sept. 1979. SFA 25(1)
[Anglian Water Auth., Diploma House, Grammar School Walk, Huntingdon, Cambs. PE18 6NZ, England] Data is presented concerning the growth of roach in a South Lancashire lake. Results from a sample of roach in May 1969 indicate the slowest growth rate for which published records are available. A comparison of the length/age and weight/age relationships between data for May 1969 and May/June 1971 yields significant between-year differences indicating an increase in the growth rate during that period. A study of the growth history of individual year classes using back-calculated values from operculum measurements suggests that for both sexes the observed increase in the rate of growth commenced after the 1965-67 period during which very weak year classes were produced. The mean length of females appears to have been larger than that of males from the age of four onwards but the 95 percent confidence intervals are almost totally overlapping for each pair of values and a statistical comparison of growth rates between the sexes indicates no significant differences. Data for the sexes combined is compared with published results from other British and Continental waters.

80-000463 Macdonald, P. D. M.; Pitcher, T. J. AGE-GROUPS FROM SIZE-FREQUENCY DATA: A VERSATILE AND EFFICIENT METHOD OF ANALYZING DISTRIBUTION MIXTURES. J. Fish. Res. Board Can. 36 (8): 987-1001. Aug. 1979. In English with French summ. SFA 25(1)
[Dep. Appl. Math., McMaster Univ., Hamilton, ON L8S 4K1, Canada]

80-000464 Methot, R. D., Jr.; Kramer, D. GROWTH OF NORTHERN ANCHOVY, /ENGRAULIS MORDAX/, LARVAE IN THE SEA. NOAA Fish. Bull. 77 (2): 413-423. Apr. 1979. SFA 25(1)
[NMFS, P.O. Box 271, La Jolla, CA 92038]

80-000465 Olatunde, A. A. AGE DETERMINATION, LENGTH-WEIGHT RELATIONSHIP AND GROWTH OF /EUTROPIUS NILOTICUS/ AND /SCHILBE MYSTUS/ IN LAKE KAINJI, NIGERIA. Arch. Hydrobiol. 87 (1): 49-83. 1979. SFA 25(1)
[Sch. Basic Stud., Ahmadu Bello Univ., Zaria, Nigeria] Pectoral spines were found to be satisfactory for age determinations and growth studies of /Eutropius nilotics/ Ruppell and /Schilbe mystus/ Linnaeus (Family Schilbeidae, Osteichthyes: Siluriformes) occurring in Lake Kainji, Nigeria. Transverse sections of the spine showed alternate translucent and opaque bands. Supporting evidences were put forward to show that the narrow opaque bands were true annuli. Annuli were laid down between July and October in /Eutropius niloticus/ and in /Schilbe mystus/ between June and September. Probably causes of annuli formation were investigated. Significant differences (P = 0.1-0.001) were found between the growth rate of males and females. The females grow faster than males of the same age. The females were longer-lived and attained a greater ultimate size. Length-weight relationships data were given. The overall pattern showed that growth of these species was isometric.

80-000466 Sadler, K. EFFECTS OF TEMPERATURE ON THE GROWTH AND SURVIVAL OF THE EUROPEAN EEL, /ANGUILLA ANGUILLA/ L. J. Fish Biol. 15 (4): 499-507. Oct. 1979. SFA 25(1)
[Cent. Elec. Res. Lab, Freshwater Biol. Unit, Ratcliffe-on-Soar Power Stn., Nottingham NG11 0EE, England] Experiments to determine the growth rate of eels (/Anguilla anguilla/ L.) at different temperatures are described and show the optimum temperature for growth to be 22-23°C. The ultimate upper lethal temperature was found to be 38°C and the critical thermal maximum varied from 33 to 39°C for fish acclimated at 14 to 29°C. An attempt was also made to determine lower lethal temperatures. Eels enter a state of torpor at temperatures varying from 3°C for fish acclimated at 29°C to less than 1°C for fish acclimated at 23°C or below. The results have been used to estimate the growth rates expected from eels cultured in power station cooling water using different types of temperature control.

80-000467 Scarnecchia, D. L. VARIATION OF SCALE CHARACTERISTICS OF COHO SALMON WITH SAMPLING LOCATION ON THE BODY. Prog. Fish-Cult. 41 (3): 132-135. July 1979. SFA 25(1)
[Colo. Coop. Fish. Res. Unit, Colo. State Univ., Fort Collins 80523]

80-000468 Smirnov, Yu. A.; Shustov, Yu. A.; Shchurov, I. L. FEATURES OF GROWTH OF YOUNG LAKE SALMON, /SALMO SALAR/ MORPHA /SEBAGO/, IN LAKE ONEGA TRIBUTARIES. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 399-403. 1978. SFA 25(1)
[Inst. Biol., USSR Acad. Sci., Karelian Branch, USSR] Differences are found in the growth of the young of /Salmo salar/ morpha /sebago/ in the tributaries of Lake Onega which differ in hydrography, and the hydrologic and hydrobiological regime. In the lake-river type of system, the growth rate of young salmon is significantly higher than in other bodies of water.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-000469 Adams, J. A.; Dooley, H. D. FISHES AND THEIR ENVIRONMENT IN THE NORTH SEA. Scott. Fish. Bull. 45: 13-23. 1979. SFA 25(1)

80-000470 Anderson, M. E.; Cailliet, G. M.; Antrim, B. S. NOTES ON SOME UNCOMMON DEEP-SEA FISHES FROM THE MONTEREY BAY AREA, CALIFORNIA. Calif. Fish Game 65 (4): 256-264. Oct. 1979. SFA 25(1)
[Va. Inst. Mar. Sci., Gloucester Point 23062]

80-000471 Banister, K. E.; Bailey, R. G. FISHES COLLECTED BY THE ZAIRE RIVER EXPEDITION, 1974-75. Zool. J. Linn. Soc. 66 (3): 205-249. July 1979. SFA 25(1)
[Dep. Zool., Brit. Mus. (Nat. Hist.), Cromwell Rd., London SW7, England] An annotated list of the fishes collected by the Zaire River Expedition, October 1974-January 1975, is presented, and five new species are described. The majority of the collections came from the River Lualaba and associated water bodies and provide new information on the distribution of the ichthyofauna in the Zaire basin. A re-examination of the available geomorphological and zoogeographical evidence failed to substantiate the hypothesis that the upper Lualaba was formerly a tributary of the Nile.

80-000472 Borroni, I.; Grimaldi, E. PRESENZA DI /BLENNIUS FLUVIATILIS/ (PISCES: BLENNIIDAE) NEL LAGO MAGGIORE. [THE PRESENCE OF THE FRESHWATER BLENNY /BLENNINUS FLUVIALITIS/ ASSO IN LAGO MAGGIORE (NORTHERN ITALY) IS ASCERTAINED FOR THE FIRST TIME.] Mem. Ist. Ital. Idrobiol. Dott. Marco de Marchi 36: 303-308. 1978. SFA 25(1)

80-000473 Bryant, R. T.; Beets, J. P.; Ryon, M. G. REDISCOVERY OF THE SHARPHEAD DARTER, /ETHEOSTOMA ACUTICEPS/, IN NORTH CAROLINA (PISCES: PERCIDAE). Brimleyana No. 2. p. 137-140. Nov. 1979. SFA 25(1)
[Grad. Prog. Ecol., Univ. Tenn., Knoxville 37916]

80-000474 Burr, B. M.; Cashner, R. C.; Pflieger, W. L. /CAMPOSTOMA OLIGOLEPIS/ AND /NOTROPIS OZARCANUS/ (PISCES: CYPRINIDAE), TWO ADDITIONS TO THE KNOWN FISH FAUNA OF THE ILLINOIS RIVER, ARKANSAS AND OKLAHOMA. Southwest. Nat. 24 (2): 381-383. 31 July 1979. SFA 25(1)
[Dep. Zool., South. Ill. Univ., Carbondale 62901]

80-000475 Cook, K. D. FISH POPULATION STUDY OF WEST CACHE CREEK WITH EMPHASIS ON SEARCH FOR THE WICHITA SPOTTED BASS, /MICROPTERUS PUNCTULATUS WICHITAE/. Proc. Okla. Acad. Sci. 59: 1-3. 1979. SFA 25(1)
[Okla. Dep. Wildl. Conserv., Star Route, Box 66E, Lawton 73501] This study was initiated to determine the status of the Wichita spotted bass, /Micropterus punctulatus wichitae/, last collected in West Cache Creek, Oklahoma in 1928. West Cache Creek on the Wichita Mountains National Wildlife Refuge was sampled with seines, electrofishing, rotenone, and hook and line in an attempt to collect specimens of the Wichita spotted bass. A total of 98 bass were collected, none of which were identified as the target subspecies. It was determined that the Wichita spotted bass is probably no longer present in the area. Other species collected are listed.

80-000476 Courtenay, W. R., Jr.; Hensley, D. A. RANGE EXPANSION IN SOUTHERN FLORIDA OF THE INTRODUCED SPOTTED TILAPIA, WITH COMMENTS ON ITS ENVIRONMENTAL IMPRESS. Environ. Conserv. 6 (2): 149-151. 1979. SFA 25(1)
[Dep. Biol. Sci., Fla. Atl. Univ., Boca Raton 33431] The Spotted Tilapia, /Tilapia mariae/, apparently introduced to Dade County, Florida, between 1972 and 1974, has expanded its range dramatically. This exotic fish is now established in three counties (Broward, Collier, and Dade) in canals and lakes in an area encompassing approximately 2,000 km². Field observations and collections indicate that the Spotted Tilapia is common and sometimes a dominant (in excess of 50 percent of the total fish-biomass) species in canals of eastern Dade County. There have been apparent decreases in populations of native and some exotic fishes in these same waters that were probably attributable to direct competition and population increases by this aggressive cichlid fish. /Tilapia mariae/ also appears to be established in southern Arizona.

80-000477 Francis, L. J.; Bjornn, T. C. AQUATIC RESOURCES IN THE NATURE CONSERVANCY PORTION OF SILVER CREEK. Univ. Idaho For. Wildl. Range Exp. Stn. Tech. Rep. 9. v + 84p. June 1979. SFA 25(1)
[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843]

80-000478 Froiland, O. FISH TYPES IN THE ZOOLOGICAL MUSEUM, UNIVERSITY OF BERGEN, NORWAY. Sarsia 64 (3): 143-154. 1979. SFA 25(1)
[Fiskerimuseet, Nordahl Bruns gt. N-5000 Bergen, Norway]

80-000479 Fursa, T. I.; Movchan, Yu. V. THE FISH FAUNA OF THE SOUTHWEST COAST OF INDIA. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 351-362. 1978. SFA 25(1)
[AzCherNIRO, Kerch, USSR]

80-000480 Goren, M. THE GOBIINAE OF THE RED SEA (PISCES: GOBIIDAE). Senckenb. Biol. 60 (1/2): 13-64. 15 Aug. 1979. SFA 25(1)
[Dep. Zool., Tel-Aviv Univ., 155 Herzl St., Tel-Aviv, Israel]

80-000481 Hendricks, M. L.; Stauffer, J. R., Jr.; Hocutt, C. H.; Gilbert, C. R. A PRELIMINARY CHECKLIST OF THE FISHES OF THE YOUGHIOGHENY RIVER. Nat. Hist. Misc. (Chic.) No. 203. 15p. 1 Feb. 1979. SFA 25(1)
[Appalachian Environ. Lab., Univ. Md., Frostburg 21532]

80-000482 Kalinina, E. M.; Podosinnikov, A. Yu. QUALITATIVE COMPOSITION AND SEASONAL CHANGES IN THE CANARY CURRENT ICHTHYOPLANKTON. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 495-500. 1978. SFA 25(1)
[Inst. Biol. South. Seas, Ukrainian SSR Acad. Sci., Sevastopol, USSR]

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ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

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[Calif. State Water Resour. Bd., P.O. Box 100, Sacramento 95801]
This study attempted to clarify some effects of forest fires on streams in selected tributaries to Yellowstone Lake, Yellowstone National Park, in partial evaluation of the Park's natural burn fire management policy. In a stream in a watershed burned 45 and 36 years ago (Passage Creek) some changes were found, when compared to a similar stream in an unburned adjacent watershed (Chipmunk Creek). Summer stream temperatures averaged about 1.5 C higher in Passage Creek. Streamflow showed a greater seasonal fluctuation and a higher water yield in Passage Creek. Water quality conditions in both streams were similar, but mineral export was greater in Passage Creek due to greater water yield. Aufwuchs accumulation on artificial substrates showed no significant difference between the two streams. Benthic

80-000499 CONTINUED
sampling suggested a general increase in benthic macroinvertebrates in Passage Creek. The fry of Yellowstone cutthroat trout, /Salmo clarki lewisi/, appeared to emerge from the gravel earlier in Passage Creek than in Chipmunk Creek. Based on stream temperature differences, the difference in egg incubation time was calculated to be 4 days. Two other streams were studied during and immediately after a fire burned their watersheds (Streams 173 and 174). No harmful effects were found. Concentrations of calcium, magnesium, potassium, chloride, sulfate, phosphate, and total organic carbon were raised somewhat during a rainstorm, apparently as a result of ash leached into surface runoff.

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[Yorkshire Water Auth. (Sci. Serv.), Olympia House, Gelderd Rd., Leeds LS12 6DD, England] Five-hundred and fifty-nine perch (/Perca fluviatilis/ L.) were examined from Llyn Tegid between January 1975-July 1976 for protozoan and metazoan parasites. Sixteen species of parasites were recorded, and these results were compared to previous studies at Llyn Tegid, and elsewhere in the British Isles. It was concluded that the parasite fauna of perch is influenced by the diversity and abundance of the local aquatic invertebrate fauna, the local ichthyofauna, the local piscivorous avian fauna and the history and geographic isolation of the environment. The importance of a large series of observations on a variety of habitats was stressed.

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[B. C. Research, 3650 Wesbrook Crescent, Vancouver, BC, Canada]
Adult sockeye salmon, /Oncorhynchus nerka/ (Walbaum), in three different stages of sexual maturity were administered the antibiotic, oxytetracycline, by injection (intraperitoneal and intramuscular), water bath exposure and stomach capsule implant. Concentrations of the antibiotic in, and its disappearance from the serum were determined. For all three stages of sexual maturity the most efficacious route of administration based on maximum titre and duration in the serum was provided by intraperitonial injection. Intramuscular application produced a positive effect, albeit at a markedly lower level, in all three groups of fish. Oral implants resulted in only a minor uptake of the antibiotic in the fully ripe fish. Immersion of the fish in water solutions of oxytetracycline was without effect.

BACTERIAL DISEASES

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[U.S. FWS, Natl Fish Health Res. Lab., Rt. 3, Box 50, Kearneysville, WV 25430] Splenic antibody-producing cells were produced by rainbow trout that had been exposed to O-antigens extracted from /Yersinia ruckeri/ and /Aeromonas salmonicida/ by adding the concentrated antigen preparation directly into the water of the tank holding the fish for flush exposure. This method was compared with the proven techniques of exposure: intraperitoneal injection or a 2 minute immersion of the fish in the antigen preparation. Dosage experiments showed that the production of antibody-producing cells was induced by the immersion of trout for 2 minutes in water with 5.0 ug ml^{-1} (or more) with the /Y. ruckeri/ O-antigen, or 500 ug ml^{-1} (or more) of the /A. salmonicida/ O-antigen. Similar differences were evident when the respective antigens were added directly to the water.

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[Fac. Fish. Anim. Husb., Hiroshima Univ., Fukuyama 720, Japan]

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[Dep. Fish., Fac. Fish. Anim. Husb., Hiroshima Univ., Fukuyama 720, Japan] Immune response of the Japanese eel (/Anguilla japonica/; average weight: 70 g) to formalin-killed /Pseudomonas anguilliseptica/ cells administered intramuscularly was studied. Experimental fish had no specific agglutinin acquired naturally. Agglutinating antibody was detected 2 weeks after vaccination at water temperatures from 15°C to 28°C and the antibody response persisted over a period of 7 weeks (maximum titer: 256), and even at 10°C it was detected as late as 7 weeks after vaccination (titer: 2). And the antibody response in the eels immunized at about 20°C was maintained over 5 months through the low temperature period (minimum: 7°C). The use of Freund's complete adjuvant had a promotive effect on the development of agglutinin titer (maximum: 4096). Vaccinated eels were highly protected against experimental infection with virulent /P. anguilliseptica/, and this protective immune response was demonstrated even after wintering. These results suggest that this vaccination method will provide cultured eels with protective immunity against naturally occurring red spot disease.

80-000542 Newman, S. G. PRODUCTION AND ROLES OF FACTORS INVOLVED IN THE PATHOGENESIS OF /VIBRIO ANGUILLARUM/ STRAIN LS-74 STUDIED IN JUVENILE CHINOOK SALMON (/ONCORHYNCHUS TSHAWYTSCHA/). Ph.D. dissertation, Univ. Miami 136p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(4):1538. Oct. 1979. SFA 25(1)

80-000543 Paterson, W. D.; Gallant, C.; Desautels, D.; Marshall, L. DETECTION OF BACTERIAL KIDNEY DISEASE IN WILD SALMONIDS IN THE MARGAREE RIVER SYSTEM AND ADJACENT WATERS USING AN INDIRECT FLUORESCENT ANTIBODY TECHNIQUE. J. Fish. Res. Board Can. 36 (12): 1464-1468. Dec. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Halifax Lab., Halifax, NS B3J 2S7, Canada]

80-000544 Weber, J. M.; Zwicker, B. M. /AEROMONAS SALMONICIDA/ IN ATLANTIC SALMON (/SALMO SALAR/): OCCURRENCE OF SPECIFIC AGGLUTININS TO THREE BACTERIAL PATHOGENS. J. Fish. Res. Board Can. 36 (9): 1102-1107. Sept. 1979. In English with French summ. SFA 25(1)
[Dep. Natl. Health Welfare, Health Prot. Br., Lab. Cent. Dis. Control, Bur. Virol., Ottawa, ON K1A 0L2, Canada]

FUNGAL DISEASES

80-000545 Taylor, S. G.; Bailey, J. E. /SAPROLEGNIA/: CONTROL OF FUNGUS ON INCUBATING EGGS OF PINK SALMON BY TREATMENT WITH SEAWATER. Prog. Fish-Cult. 47 (4): 181-183. Oct. 1979. SFA 25(1)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

PROTOZOAN DISEASES

80-000546 Burreson, E. M. STRUCTURE AND LIFE CYCLE OF /TRYPANOPLASMA BECKERI/ SP. N. (KINETOPLASTIDA), A PARASITE OF THE CABEZON, /SCORPAENICHTHYS MARMORATUS/, IN OREGON COASTAL WATERS. J. Protozool. 26 (3): 343-347. Aug. 1979. SFA 25(1)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, VA 23062]

80-000547 Duszynski, D. W.; Solangi, M. A.; Overstreet, R. M. A NEW AND UNUSUAL EIMERIAN (PROTOZOA: EIMERIIDAE) FROM THE LIVER OF THE GULF KILLIFISH, /FUNDULUS GRANDIS/. J. Wildl. Dis. 15 (4): 543-552. Oct. 1979. SFA 25(1)
[Dep. Biol., Univ. N. Mex., Albuquerque 87131]

80-000548 Pange, R. PROTOZOAN INFECTIONS (HAEMOGREGARINES, TRYPANOSOMES) OF THE BLOOD OF THE GADOID FISH, /MELANOGRAMMUS AEGLEFINUS/ (HADDOCK) AND /GAIDROPSAURUS CIMBRIUS/ (FOUR-BEARDED ROCKLING). Acta Zool. (Stockh.) 60 (3): 129-137. 1979. SFA 25(1)
[Dep. Zoophysiol., Univ. Gothenburg, Sweden] Parasitic protozoans, identified as /Haemogregarina aeglefini/ (Henry), were found in erythrocytes of two gadiform fish, /Melanogrammus aeglefinus/ (haddock) and /Gaidropsaurus cimbrius/ (four-bearded rockling). The latter species also harboured trypanosomes in its blood plasma, and a kind of intracellular parasite-like inclusions in macrophages of the spleen, the pronephros and the liver. Most specimens of /Gaidropsaurus cimbrius had leeches (/Callobdella nodulifera/) attached to the skin. A remarkable abundance of blood leucocytes noted in /Gaidropsaurus cimbrius/ may be a response to haematozoan infections.

80-000549 Johnson, K. A.; Sanders, J. E.; Fryer, J. L. /CERATOMYXA SHASTA/ IN SALMONIDS. U.S. Fish Wildl. Serv. Fish Dis. Leafl. 58. 11p. 1979. SFA 25(1)
[Oreg. State Univ., Corvallis]

80-000550 Joshi, B. D. TWO NEW SPECIES OF TRYPANOSOMES FROM TWO FRESH WATER TELEOSTS. J. Anim. Morphol. Physiol. 25 (1/2): 1-7. June-Dec. 1978. SFA 25(1)
[Dep. Zool., Cnostituent Coll., Kumaun Univ., Almora, U.P., India]

80-000551 Kirmse, P. OBSERVATIONS ON THE ULTRASTRUCTURE OF /HAEMOGREGARINA SIMONDI/ IN THE MARINE FLATFISH /SOLEA SOLEA/ (L.). Z. Parasitenkd. 59 (2): 131-140. 1979. SFA 25(1)
[Unit Aquatic Pathobiol., Dep. Biol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-000552 Kirmse, P. REDESCRIPTION OF THE LIFE CYCLE OF /HAEMORGREGARINA SIMONDI/ (LAVERAN AND MESNIL, 1901) IN ITS VERTEBRATE HOST THE MARINE FISH /SOLEA SOLEA/ (LINNAEUS). Z. Parasitenkd. 59 (2): 141-150. 1979. SFA 25(1)
[Unit Aquatic Pathobiol., Dep. Biol., Univ. Stirling, Stirling FK9 4LA, Scotland]

VIRAL DISEASES

80-000553 Grinnell, B.; Leong, J. C. RECOVERY AND CONCENTRATION OF INFECTIOUS PANCREATIC NECROSIS (IPN) VIRUS IN WATER. J. Fish. Res. Board Can. 36 (11): 1405-1408. Nov. 1979. In English with French summ. SFA 25(1)
[J. C. Leong: Oreg. State Univ., Corvallis 97331]

80-000554 MacMillan, J. R.; Mulcahy, D. ARTIFICIAL TRANSMISSION TO AND SUSCEPTIBILITY OF PUGET SOUND FISH TO VIRAL ERYTHROCYTIC NECROSIS (VEN). J. Fish. Res. Board Can. 36 (9): 1097-1101. Sept. 1979. In English with French summ. SFA 25(1)
[U.S. FWS, Bldg. 204, Naval Support Activity, Seattle, WA 98115]

80-000555 Plumb, J. A.; Bowser, P. R.; Grizzle, J. M.; Mitchell, A. J. FISH VIRUSES: A DOUBLE-STRANDED RNA ICOSAHEDRAL VIRUS FROM A NORTH AMERICAN CYPRINID. J. Fish. Res. Board Can. 36 (11): 1390-1394. Nov. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Allied Aquacult., Agric. Exp. Stn., Auburn Univ., Auburn, AL 36830]

80-000556 Vaughan, G. E. COMPARATIVE VULNERABILITY OF BLUEGILLS WITH AND WITHOUT LYMPHOCYSTIS DISEASE TO PREDATION BY LARGEMOUTH BASS. Prog. Fish-Cult. 41 (3): 163-164. July 1979. SFA 25(1)
[U.S. FWS, Nashua Natl. Fish Hatchery, Nashua, NH 03060]

OTHER DISEASES AND PARASITES

80-000557 Baker, M. R. REDESCRIPTION OF /CAMALLANUS ANCYLODIRUS/ WARD AND MAGATH 1916 (NEMATODA: CAMALLANIDAE) FROM FRESHWATER FISHES OF NORTH AMERICA. J. Parasitol. 65 (3): 389-392. June 1979. SFA 25(1)
[Commonwealth Inst. Helminthol., 103 St. Peter's St., St. Albans, Herts. AL1 3EW, England]

80-000558 Barkman, L. L.; James, H. A. A POPULATION STUDY OF MONOGENETIC TREMATODES FROM THE KILLIFISH, /FUNDULUS HETEROCLITUS/ (LINNAEUS) IN CONNECTICUT. Iowa State J. Res. 54 (1): 77-81. Aug. 1979. SFA 25(1)
[Housatonic Community Coll., Bridgeport, CT 06608] /Fundulotrema prolongis/ (Hargis, 1955) Kritsky and Thatcher 1977 (=/Gyrodactylus prolongis/ Hargis, 1955), /Gyrodactylus stephanus/ Mueller, and /Urocleidus angularis/ Mueller were recovered from 68 male and 115 female killifish [/Fundulus heteroclitus/ (Linnaeus)] taken from a brackish pond in Bridgeport (Fairfield Co.) Connecticut, at 14 monthly intervals from September 1975 to November 1976. For approximately 8,230 monogenean recovered, sites on host, incidence of infection, and intensity of infection were determined. Seasonal parasite burden was examined relative to total length of host, sex of host, and water temperature. Large hosts and female hosts tended to have more parasites. Population peaks of monogenean species (three from gills and one from sediment) occurred in February, March, April, and June at water temperatures of 5°C, 9.5°C, 14°C, and 30°C, respectively.

80-000559 Bilqees, F. M. /RHABDOCHONA PARASTROMATEI/ SP. N. (NEMATODA, RHABDOCHONIDAE) FROM THE FISH /PARASTROMATEUS NIGER/ (BLEEKER) OF THE KARACHI COAST. Zool. Scr. 8 (2): 107-110. 1979. SFA 25(1)
[Sch. Parasitol., Dep. Zool., Univ. Karachi, Karachi, Pakistan]

80-000560 Blasiola, G. C., Jr. /SERPENTISACCUS MAGNIFICAE/ GEN. ET SP. N., A COPEPOD (CALIGOIDA: LERNAEOCERIDAE) FROM THE FIREFISH, /NEMATELEOTRIS MAGNIFICA/ FOWLER, 1938. J. Parasitol. 65 (4): 662-665. Aug. 1979. SFA 25(1)
[Steinhart Aquarium, Calif. Acad. Sci., San Francisco, CA 94118]

80-000561 Brandal, P. O.; Egidius, E. TREATMENT OF SALMON LICE (/LEPEOPHTHEIRUS SALMONIS/ KROYER, 1838) WITH NEGUVON--DESCRIPTION OF METHOD AND EQUIPMENT. Aquaculture 18 (2): 183-188. Oct. 1979. SFA 25(1)
[Inst. Mar. Res., C. Sundtsgt. 37,5000 Bergen, Norway] A bath treatment of 300 p.p.m. Neguvon for 15-60 min effectively eliminates the salmon louse, /Lepeophtheirus salmonis/, from salmonids cultured in sea water. Serious epizootics caused by this parasite have arisen in recent years in Norwegian salmonid farms. The treatment is applied using a special floating pen enabling the same solution to be used for different fish populations. Neguvon residues in treated fish are negligible within 12 days of treatment. Fish should not be harvested within 3 weeks of treatment and the Neguvon should be used under veterinary prescription in Norway.

80-000562 Dartnall, H. J. G.; Walkey, M. THE DISTRIBUTION OF GLOCHIDIA OF THE SWAN MUSSEL, /ANODONTA CYGNEA/ (MOLLUSCA) ON THE THREE-SPINED STICKLEBACK /GASTEROSTEUS ACULEATUS/ (PISCES). J. Zool. (Lond.) 189 (1): 31-37. Sept. 1979. SFA 25(1)
[Brit. Antarctic Surv., Madingley Rd., Cambridge, England]

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[Limnological Assoc., P.O. Box 1056, Kaneohe, HI 96744]

80-000564 Gayevskaya, A. V.; Kovaljova, A. A. [MONOGENEANS FROM THE ATLANTIC HORSE MACKERELS OF THE GENUS /TRACHURUS/.] Zool. Zh. 58 (8): 1110-1116. Aug. 1979. In Russian with English summ. SFA 25(1)
[Atl. Res. Inst. Fish. Oceanogr., Kaliningrad, USSR]

80-000565 Ghichenok, L. A. [MONOGENEANS FROM FLYING FISHES OF THE GENUS /EXOCOETUS/ (BELONIFORMES) FROM THE INDIAN AND PACIFIC OCEANS.] Zool. Zh. 58 (7): 958-968. July 1979. In Russian with English summ. SFA 25(1)
[Biol. Fac., Univ. Moscow, USSR]

80-000566 Hanson, A. W. /DICLIDOPHORA EMBIOTOCAE/ SP. N. (MONOGENEA, DICLIDOPHORIDAE), A PARASITE OF EMBIOTOCID FISHES OF OREGON. J. Parasitol. 65 (3): 457-459. June 1979. SFA 25(1)
[Dep. Biol., Whittier Coll., Whittier, CA 90608]

80-000567 Hendrickson, G. L. /ORNITHODIPLOSTOMUM PTYCHOCHEILUS/: MIGRATION TO THE BRAIN OF THE FISH INTERMEDIATE HOST, /PIMEPHALES PROMELAS/. Exp. Parasitol. 48 (2): 245-258. Oct. 1979. SFA 25(1)
[Dep. Fish., Humboldt State Univ., Arcata, CA 95521]

80-000568 Hewitt, G. C. EIGHT SPECIES OF PARASITIC COPEPODA ON A WHITE SHARK. N.Z. J. Mar. Freshwater Res. 13 (1): 171. 1979. SFA 25(1)
[Zool. Dep., Victoria Univ. Wellington, Private Bag, Wellington, New Zealand] The Copepoda /Nemesis lamna/, /Pandarus satyrus/, /Nesippus orientalis/, /Pandarus bicolor/, /Echthrogaleus coleoptratus/, /E. denticulatus/, /Dinemoura latifolia/, and /D. producta/ are recorded from a specimen of /Carcharodon carcharias/ taken near Wellington, New Zealand. Evidence is given that at least one species has undergone habitat shift due to site competition.

80-000569 Kennedy, C. R. THE DISTRIBUTION AND BIOLOGY OF THE CESTODE /EUBOTHRIUM PARVUM/ IN CAPELIN, /MALLOTUS VILLOSUS/, (PALLAS) IN THE BARENTS SEA, AND ITS USE AS A BIOLOGICAL TAG. J. Fish Biol. 15 (2): 223-236. Aug. 1979. SFA 25(1)
[Dep. Biol. Sci., The University, Exeter, England]

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[DAFS, Mar. Lab., Victoria Rd., Aberdeen AB9 8DB, Scotland]

80-000571 Prabha, C.; Pillai, N. K. /PSEUDECHETUS FIMBRIATUS/ GEN. ET SP. NOV., A CALIGID COPEPOD FROM KERALA COASTAL WATERS. Parasitology 79 (3): 425-429. Dec. 1979. SFA 25(1)
[Dep. Aquatic Biol. Fish., Univ. Kerala, Trivandrum 695007, India]

80-000572 Rohde, K. MONOGENEAN GILL PARASITES OF SOME MARINE FISHES OF PAPUA NEW GUINEA. Zool. Anz. 203 (1/2): 78-94. 1979. In English with German summ. SFA 25(1)
[Dep. Zool., Univ. New England, Armidale, Australia]

80-000573 Romestand, B.; Trilles, J.-P. INFLUENCE DES CYMOTHOADIENS /MEINERTIA OESTROIDES/, /MEINERTIA PARALLELA/ ET /ANILOCRA PHYSODES/ (CRUSTACES, ISOPODES; PARASITES DE POISSONS) SUR LA CROISSANCE DES POISSONS HOTES /BOOPS BOOPS/ ET /PAGELLUS ERYTHRINUS/ (SPARIDES). [INFLUENCE OF THE CYMOTHOID ISOPODS /MEINERTIA OESTROIDES/, /MEINERTIA PARALLELA/, AND /ANILOCRA PHYSODES/ (CRUSTACEA; PARASITES OF FISH) ON THE GROWTH OF HOSTS, /BOOPS BOOPS/ AND /PAGELLUS ERYTHRINUS/ (SPARIDAE).] Z. Parasitenkd. 59 (2): 195-202. 1979. In French with English summ. SFA 25(1)
[Univ. Sci. Tech. Languedoc, Montpellier, France]

80-000574 Sogandares-Bernal, F.; Hietala, H. J.; Gunst, R. F. METACERCARIAE OF /ORNITHODIPLOSTOMUM PTYCHOCHEILUS/ (FAUST, 1917) DUBOIS, 1936 ENCYSTED IN THE BRAINS AND VISCERA OF RED-SIDED SHINERS FROM THE CLARK-FORK AND BITTERROOT RIVERS OF MONTANA: AN ANALYSIS OF THE INFECTED HOSTS. J. Parasitol. 65 (4): 616-623. Aug. 1979. SFA 25(1)
[Dep. Biol., South. Methodist Univ., Dallas, TX]

80-000575 Tkachuk, L. P. [NEW SPECIES OF TREMATODES FROM THE DEEPWATER ZEIDAE OF THE INDIAN AND ATLANTIC OCEANS.] Zool. Zh. 58 (9): 1290-1295. Sept. 1979. In Russian with English summ. SFA 25(1)
[Inst. Biol. South Seas, Acad. Sci. Ukrainian SSR, Sevastopol, USSR]

80-000576 Wood, C. M.; McMahon, B. R.; McDonald, D. G. RESPIRATORY, VENTILATORY, AND CARDIOVASCULAR RESPONSES TO EXPERIMENTAL ANAEMIA IN THE STARRY FLOUNDER, /PLATICHTHYS STELLATUS/. J. Exp. Biol. 82: 139-162. Oct. 1979. SFA 25(1)
[Dep. Biol., McMaster Univ., 1280 Main St. West, Hamilton, ON L8S 4K1, Canada] Unrestrained, quiescent starry flounder maintained approximately normal levels of O(2) uptake in the face of severe experimental anaemia. At haematocrits above about 5 percent, the only major compensation was a reduction in venous O(2) tension which lowered venous saturation and thereby kept a constant difference between arterial and venous O(2) contents. Below a haematocrit of about 5 percent, this difference decreased, and many additional compensations were invoked, including increases in ventilation, expired O(2) tension, arterial O(2) tension, and cardiac output, and decreases in systemic vascular resistance and blood pH. All changes could be reversed by restoration of haematocrit. Exercise performance and post-exercise changes in blood pH and lactate differed only slightly between anaemic and normal flounder. In wild flounder, anaemia commonly occurs and apparently only causes death at the haematocrit value (about 5 percent) below which most major compensations are implemented. The respiratory strategy of the flounder during anaemia is compared with that of the rainbow trout.

POLLUTION

80-000577 Ames, L. J.; Felley, J. D.; Smith, M. H. AMOUNTS OF ASYMMETRY IN CENTRARCHID FISH INHABITING HEATED AND NONHEATED RESERVOIRS. Trans. Am. Fish. Soc. 108 (5): 489-495. Sept. 1979. SFA 25(1)
[J. D. Felley: Dep. Zool., Univ. Okla., Norman 73019]

80-000578 Amico, V.; Impellizzeri, G.; Oriente, G.; Piattelli, M.; Sciuto, S.; Tringali, C. LEVELS OF CHLORINATED HYDROCARBONS IN MARINE ANIMALS FROM THE CENTRAL MEDITERRANEAN. Mar. Pollut. Bull. 10 (10): 282-284. Oct. 1979. SFA 25(1)
[Ist. Dip. Chim. Chim. Ind., Univ. Catania, Catania, Italy]

80-000579 Black, J. J. CARCINOGENIC HAZARDS IN AQUATIC ECOSYSTEMS. Ph.D. dissertation, State Univ. N.Y. (Buffalo) 121p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(4):1608. Oct. 1979. SFA 25(1)
A portion of the Western New York Great Lakes aquatic environment was examined for polynuclear aromatic hydrocarbon (PAH) pollution. Chemical characterization of contaminants present in bottom sediments was carried out using reversed phase high pressure liquid chromatography (HPLC) applied to fractions which were derived by routine organic extraction and separation methods. The HPLC chromatograms obtained from the bottom sediments and those from analogous fractions isolated from tissue samples of aquatic biota were compared. Correlations in the PAH composition of the contaminated sediments to that found in the biota were demonstrated. The HPLC analysis of fractions isolated from sediment, Tubifex worms, aquatic snails and fish tissue samples clearly indicated the presence of a characteristic PAH "fingerprint" in all segments of the aquatic food chain. The patterns of horizontal distribution of the relative levels of PAH clearly indicate a point source of the pollution in the Buffalo River. A sample of the feral fish population indicated the presence of several kinds of lesions that appear to be neoplasms. The histology of these lesions is described. The significance of the results in terms of a possible hazard to human health is discussed.

80-000580 Bollingberg, H. J.; Johansen, P. LEAD IN SPOTTED WOLFFISH, /ANARHICHAS MINOR/, NEAR A ZINC-LEAD MINE IN GREENLAND. J. Fish. Res. Board Can. 36 (9): 1023-1028. Sept. 1979. In English with French summ. SFA 25(1)
[Inst. Petrol., Univ. Copenhagen, Oster Voldgade 7, 1350 Copenhagen K, Denmark]

80-000581 Burton, D. T.; Hall, L. W., Jr.; Margrey, S. L.; Small, R. D. INTERACTIONS OF CHLORINE, TEMPERATURE CHANGE (DELTA T), AND EXPOSURE TIME ON SURVIVAL OF STRIPED BASS (/MORONE SAXATILIS/) EGGS AND PROLARVAE. J. Fish. Res. board Can. 36 (9): 1108-1113. Sept. 1979. In English with French summ. SFA 25(1)
[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612]

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[West. Aust. Mar. Res. Lab., P.O. Box 20, North Beach, Western Australia 6020]

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[Inst. Environ. Res., Fac. Sci., Chulalongkorn Univ., Bangkok, Thailand]

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[Biol. Dep. VPI&SU, Blacksburg, VA 24061]

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[Dep. Zool., University, Newcastle-upon-Tyne NE1 7RU, U.K.]

80-000586 Cole, H. A. , (organizer) THE ASSESSMENT OF SUBLETHAL EFFECTS OF POLLUTANTS IN THE SEA. Philos. Trans. R. Soc. Lond. B Biol. Sci. 286 (1015): 397-633. 9 Aug. 1979. SFA 25(1)
A collection of papers.

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[Ist. Chim. Gen., Univ. Genoa, Genoa, Italy]

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[Environ. Carcinogin. Unit, B.C. Cancer Res. Cent., Vancouver, BC V5Z 1L3, Canada]

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[M. G. Norton: Fish. Lab , Burnham-on-Crouch, U.K.]

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[U.S. Food Drug Admin., 850 Third Ave., Brooklyn, NY 11232]

80-000592 Grove, P.; Moller, P. ELECTRIC FISH AS A TOOL FOR WATER QUALITY ASSESSMENT. Trans. Am. Fish. Soc. 108 (4): 420-421. July 1979. SFA 25(1)
[City Coll. City Univ. N.Y., New York 10031]

80-000593 Heit, M. VARIABILITY OF THE CONCENTRATIONS OF SEVENTEEN TRACE ELEMENTS IN THE MUSCLE AND LIVER OF A SINGLE STRIPED BASS, /MORONE SAXATILIS/. Bull. Environ. Contam. Toxicol. 23 (1/2): 1-5. Sept. 1979. SFA 25(1)
[Environ. Measurements Lab., U.S. Dep. Energy, New York, NY 10014]

80-000594 Milner, N. J. ZINC CONCENTRATIONS IN JUVENILE FLATFISH. J. Mar. Biol. Assoc. U.K. 59 (3): 761-775. Aug. 1979. SFA 25(1)
[Univ. Wales, Inst. Sci. Technol., Field Cent., Newbridge-on-Wye, Powys, Wales]

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[Tokyo Metro. Res. Lab. Pub. Health 24-1, 3-chome, Hyakuninchо, Shinjuku-ku, Tokyo, 160 Japan]

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[Fish. Environ. Can., 1707 Lower Water St., P.O. Box 550, Halifax, NS B3J 2S7, Canada]

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[Dep. Anim. Ecol., Iowa State Univ., Ames 50011] In the spring and summer of 1976, a water-sampling program was carried out on the streams of Marion and Mahaska counties, where a significant portion of the coal mining in Iowa has occurred. Streams with underground mines or combinations of underground and surface mines in their watersheds had decreased values for alkalinity and increased values for specific conductance and sulfates, indicating the presence of acid mine drainage. Unless reclamation procedures are incorporated into standard mining operations, an expansion of Iowa coal mining could lead to an increase in the severity of this problem.

80-000598 Wieman, D. A.; Clady, M. D. FLORIDA AND NORTHERN LARGEMOUTH BASS: GROWTH AND SURVIVAL IN A HEATED RESERVOIR. Proc. Okla. Acad. Sci. 59: 47-50. 1979. SFA 25(1)
[Okla. Dep. Wildl. Conserv., 1801 N. Lincoln Blvd., Oklahoma City 73105] In Boomer Lake, a shallow, turbid Oklahoma reservoir receiving a heated effluent, Florida largemouth bass (/Micropterus salmoides floridanus/) grew significantly faster than northern largemouth bass (/M. s. salmoides/) during the first summer of life. Because Florida bass were smaller when stocked, however, the faster growth does not indicate a difference in growth potential. On the average, Florida and northern bass were the same size by the first fall, and the two subspecies grew at a similar rate over the next 1.5 years. Both subspecies suffered heavy initial mortality, presumably from stocking stress. After the first summer, the survival of northern bass was: winter 1976-77, 100 percent; summer 1977, 97 percent; and winter 1977-78, 45 percent. Seasonal survival rates of Florida bass over the same periods, 43, 45, and 58 percent, respectively, were independent of winter severity. Total survival of northern bass (10 percent) was significantly higher than that of Florida bass (1 percent) over 2 years. Florida bass offer no apparent management benefits in Boomer Lake.

80-000599 Niimi, A. J. HEXACHLOROBENZENE (HCB) LEVELS IN LAKE ONTARIO SALMONIDS. Bull. Environ. Contam. Toxicol. 23 (1/2): 20-24. Sept. 1979. SFA 25(1)
[Great Lakes Biolimnol. Lab., 867 Lakeshore Rd., Burlington, ON L7R 4A6, Canada]

80-000600 Niimi, A. J.; Burnison, G. A. RECOVERY OF ^{14}C-LABELLED POLYCHLORINATED BIPHENYLS (PCB) IN FISH TISSUE USING A COMBUSTION AND A SOLUBILIZATION METHOD OF SAMPLE PREPARATION FOR SCINTILLATION ANALYSIS. Bull. Environ. Contam. Toxicol. 23 (4/5): 597-600. Nov. 1979. SFA 25(1)
[Great Lakes Biolimnol. Lab., Can. Cent. Inland Waters, 867 Lakeshore Rd., Burlington, ON L7R 4A6, Canada]

80-000601 Parvaneh, V. AN INVESTIGATION ON THE MERCURY CONTAMINATION OF PERSIAN GULF FISH. Bull. Environ. Contam. Toxicol. 23 (3): 357-359. Oct. 1979. SFA 25(1)
[Dep. Food Hygiene, Univ. Tehran, P.O. Box 3262, Tehran, Iran]

80-000602 Persson, P.-E. THE SOURCE OF MUDDY ODOR IN BREAM (/ABRAMIS BRAMA/) FROM THE PORVOO SEA AREA (GULF OF FINLAND). J. Fish. Res. Board Can. 36 (8): 883-890. Aug. 1979. In English with French summ. SFA 25(1)
[Dep. Limnol., Univ. Helsinki, Viikki, SF-00710 Helsinki 71, Finland]

80-000603 Slooff, W. DETECTION LIMITS OF A BIOLOGICAL MONITORING SYSTEM BASED ON FISH RESPIRATION. Bull. Environ. Contam. Toxicol. 23 (4/5): 517-523. Nov. 1979. SFA 25(1)
[Natl. Inst. Water Supply, Chem. Biol. Div., P.O. Box 150, Leidschendam, The Netherlands]

80-000604 Smokler, P. E.; Young, D. R.; Gard, K. L. DDTS IN MARINE FISHES FOLLOWING TERMINATION OF DOMINANT CALIFORNIA INPUT: 1970-77. Mar. Pollut. Bull. 10 (11): 331-334. Nov. 1979. SFA 25(1)
[Dep. Environ. Sci. Eng., Univ. Calif., Los Angeles 90024] Through source control, total DDT annual emissions from the Los Angeles County Sanitation Districts' submarine outfalls decreased by a factor of 30 between 1971 and 1977. Here we report persistent elevated levels of DDT residues measured in three species of marine fishes with distinctly different feeding habits. Over the study interval, median levels of DDT residues have decreased 3-fold (8-fold and 4-fold from peak medians) in flesh of black perch and kelp bass. However, there was no apparent decrease in Dover sole. The sediment reservoir is the likely source of persistent contamination of fishes in the discharge area.

80-000605 Thorhaug, A.; Roessler, M. A.; Bach, S. D.; Hixon, R.; Brook, I. M.; Josselyn, M. N. BIOLOGICAL EFFECTS OF POWER-PLANT THERMAL EFFLUENTS IN CARD SOUND, FLORIDA. Environ. Conserv. 6 (2): 127-137. 1979. SFA 25(1)
[Dep. Biol. Sci., Fla. Inst. Univ., Tamiami Campus, Miami 33199]

80-000606 Veith, G. D.; DeFoe, D. L.; Bergstedt, B. V. MEASURING AND ESTIMATING THE BIOCONCENTRATION FACTOR OF CHEMICALS IN FISH. J. Fish. Res. Board Can. 36 (9): 1040-1048. Sept. 1979. In English with French summ. SFA 25(1)
[U.S. EPA, Duluth, MN 55804]

80-000607 Williams, D. C.; Hom, K. B. ONSHORE IMPACTS OF OFFSHORE OIL: A USER'S GUIDE TO ASSESSMENT METHODS. U.S. Dep. Interior 68p. May 1979. For sale by Sup. Doc. USGPO, Washington, DC, Stock no. 024-000-00859-2. SFA 25(1)

TOXICOLOGY; BIOASSAYS

80-000608 Adragna, P. J.; Privitera, C. A. ZINC EFFECTS ON LDH, MDH AND ALKALINE PHOSPHATASE FROM CULTURES OF FATHEAD MINNOW CELLS. Comp. Biochem. Physiol. B Comp. Biochem. 64 (2): 219-224. 1979. SFA 25(1)
[C. A. Privitera: Dep. Biol. Sci., State Univ. N.Y. at Buffalo, Amherst 14260] Three purported zinc metalloenzymes have been investigated from cell cultures of the fathead minnow (/Pimephales promelas/). With the addition of increasingly higher concentrations of zinc to the tissue culture medium, the specific activity of LDH increased. The results with MDH were equivocal. The specific activity of alkaline phosphatase decreased in the presence of increasing amounts of zinc in the growth medium. Zinc exogenously added to the LDH enzyme assay did not alter the LDH enzyme activity of cells grown without zinc.

80-000609 Agrawal, S. J.; Srivastava, A. K.; Chaudhry, H. S. HAEMATOLOGICAL EFFECTS OF NICKEL TOXICITY ON A FRESH WATER TELEOST, /COLISA FASCIATUS/. Acta Pharmacol. Toxicol. 45 (3): 215-217. Sept. 1979. SFA 25(1)
[A. K. Srivastava: Dep. Zool., Univ. Gorakhpur, Gorakhpur, 273001, U.P., India] /Colisa fasciatus/, a freshwater teleost, were exposed for 90 hrs to 45 p.p.m. nickel sulphate under static test conditions. The treatment resulted in leucopenia due to reduction in the number of small lymphocytes and polycythemia with concomitant increases in the haematocrit and haemoglobin values, and in retardation of the erythrocyte sedimentation rate of the moribund fish. No differences in total thrombocyte count, clotting time, and hepatosomatic index were found between the control and the treated fish. Lymphopenia and erythrocytosis may be used in presumptive monitoring nickel toxicity in fish.

80-000610 Akagi, H.; Mortimer, D. C.; Miller, D. R. MERCURY METHYLATION AND PARTITION IN AQUATIC SYSTEMS. Bull. Environ. Contam. Toxicol. 23 (3): 372-376. Oct. 1979. SFA 25(1)
[Inst. Publ. Health, Minato-ku, Tokyo, Japan]

80-000611 Alderson, R. THE EFFECT OF AMMONIA AND THE GROWTH OF JUVENILE DOVER SOLE, /SOLEA SOLEA/ (L.) AND TURBOT, /SCOPHTHALMUS MAXIMUS/ (L.). Aquaculture 17 (4): 291-309. Aug. 1979. SFA 25(1)
[Unilever Res., Colworth Lab., Lochailort, Inverness-shire, Great Britain] The growth of sole and turbot was followed in groups of fish exposed to constant unionised ammonia concentrations at pH levels both at and below that of normal sea water. Low pH levels were produced by the addition of carbon dioxide. Results for both species showed evidence for a threshold level of unionised ammonia below which little or no effect on growth was evident. This level was determined to be 0.066 mg N/l for sole and 0.11 mg N/l for turbot at 16°C, 34°/oo salinity. The different pH conditions did not have any marked effect on these threshold levels. Above the threshold levels growth appeared to be depressed in a linear manner with increased unionised ammonia. The rate at which growth was depressed was greatest at the low pH levels for both species. The level at which growth ceased thus decreased from 0.77 to 0.38 mg N/l for sole and from 0.9 to 0.3 mg N/l for turbot, over the pH range from 7.9 to 6.9. The absence of disease and gill damage in the experimental populations is discussed. It is suggested that this and the tolerance shown by the fish, which is higher than is generally accepted for fish in high density culture, may be due to the clean environment in which the fish were held while under test.

80-000612 Bouquegneau, J. M. EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INORGANIC MERCURY INJURIES TO FISH. Bull. Environ. Contam. Toxicol. 23 (1/2): 218-219. Sept. 1979. SFA 25(1)
[Lab. Oceanol., Univ. Liege, B-4000 Sart-Tilman par Liege 1, Belgium]

80-000613 Chambers, J. E.; Heitz, J. R.; McCorkle, F. M.; Yarbrough, J. D. ENZYME ACTIVITIES FOLLOWING CHRONIC EXPOSURE TO CRUDE OIL IN A SIMULATED ECOSYSTEM. II. STRIPED MULLET. Environ. Res. 20 (1): 140-147. Oct. 1979. SFA 25(1)
[Dep. Biol. Sci., Miss. State Univ., Mississippi State 39762]
Enzyme activities were investigated in brain, gill, liver, and muscle homogenates from striped mullet which had been exposed to crude oil for 10 months in a simulated estuarine ecosystem. Enzymes assayed included acetylcholinesterase, alkaline phosphatase, beta-glucuronidase, glutamic-pyruvic transaminase, lactic dehydrogenase, and malic dehydrogenase. Few seasonal trends in enzyme activities were observed. Alterations in some enzyme activities, particularly acetylcholinesterase, beta-glucuronidase, and malic dehydrogenase, may have reflected physiological changes in the mullet resulting from stress. In general, there were few chronic alterations in mullet enzyme activities resulting from the oil spill.

80-000614 Cherry, D. S.; Larrick, S. R.; Giattina, J. D.; Dickson, K. L.; Cairns, J., Jr. AVOIDANCE AND TOXICITY RESPONSES OF FISH TO INTERMITTENT CHLORINATION. Environ. Int. 2 (2): 85-90. 1979. SFA 25(1)
[Cent. Environ. Stud., VPI & SU, Blacksburg, VA 24061]

80-000615 Clingbine, G.; Heading, C. E. EFFECT OF NEUROTUBULE DISRUPTING AGENTS ON GOLDFISH BEHAVIOUR. Physiol. Behav. 23 (2): 229-236. Aug. 1979. SFA 25(1)
[Dep. Paramed. Sci., North East Lond. Polytech., Romford Rd., London E. 15, England]

80-000616 Coats, J. R.; O'Donnell-Jeffery, M. L. TOXICITY OF FOUR SYNTHETIC PYRETHROID INSECTICIDES TO RAINBOW TROUT. Bull. Environ. Contam. Toxicol. 23 (1/2): 250-255. Sept. 1979. SFA 25(1)
[Dep. Entomol., Iowa State Univ., Ames 50011]

80-000617 Crecelius, E. A. MEASUREMENTS OF OXIDANTS IN OZONIZED SEAWATER AND SOME BIOLOGICAL REACTIONS. J. Fish. res. Board Can. 36 (8): 1006-1008. Aug. 1979. In English with French summ. SFA 25(1)
[Battelle Pac. Northwest Lab., Mar. Res. Lab., Sequim, WA 98382]

80-000618 de March, B. G. E. SURVIVAL OF /HYALELLA AZTECA/ (SAUSSURE) RAISED UNDER DIFFERENT LABORATORY CONDITIONS IN A PH BIOASSAY, WITH REFERENCES TO COPPER TOXICITY. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 894. iv + 5p. Oct. 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., Winnipeg, MB R3T 2N6, Canada]

80-000619 Pandrei, G.; Collins, H. L. TOTAL RESIDUAL CHLORINE: THE EFFECT OF SHORT-TERM EXPOSURE ON THE EMERALD SHINER /NOTROPIS ATHERINOIDES/ (RAFINESQUE). Bull. Environ. Contam. Toxicol. 23 (1/2): 262-268. Sept. 1979. SFA 25(1)
[Surface and Ground Water, Minn. Pollut. Control Agency, 1975 County Road B-2, Roseville 55113]

80-000620 Feroz, M.; Khan, M. A. Q. FATE OF ^{14}C-CIS-CHLORDANE IN GOLDFISH, /CARASSIUS AURATUS/ (L.). Bull. Environ. Contam. Toxicol. 23 (1/2): 64-69. Sept. 1979. SFA 25(1)
[Dep. Biol. Sci., Univ. Ill., Box 4348, Chicago 60680]

80-000621 Ferreira, J. T.; Smit, G. L.; Schoonbee, H. J.; Holzapfel, C. W. COMPARISON OF ANESTHETIC POTENCY OF BENZOCAINE HYDROCHLORIDE AND MS-222 IN TWO FRESHWATER FISH SPECIES. Prog. Fish-Cult. 41 (3): 161-163. July 1979. SFA 25(1)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa]

80-000622 Flos, R.; Caritat, A.; Balasch, J. ZINC CONTENT IN ORGANS OF DOGFISH (/SCYLIORHINUS CANICULA/ L.) SUBJECT TO SUBLETHAL EXPERIMENTAL AQUATIC ZINC POLLUTION. Comp. Biochem. Physiol. C Comp. Pharmacol. 64 (1): 77-81. 1979. SFA 25(1)
[Dep. Fisiol. Anim., Fac. Cienc., Univ. Autonoma Barcelona, Belleterra, Barcelona, Spain] Zn content of liver, pancreas, spleen, kidney, and muscle of zinc-treated and untreated dogfish were analysed. Liver and spleen accumulate Zn after 14 days of treatment; liver, spleen and pancreas, after 25 days. According to the Wilcoxon test, liver Zn accumulation was significantly higher than spleen at 14 days. The pancreas accumulate significantly more Zn than liver and spleen at 25 days. Comparing the results with our work on the effect of Zn in gills, we conclude that when working in sublethal conditions (15 ppm) Zn toxicity would be bound to organs injury.

80-000623 Goodman, L. R.; Hansen, D. J.; Coppage, D. L.; Moore, J. C.; Matthews, E. DIAZINON: CHRONIC TOXICITY TO, AND BRAIN ACETYLCHOLINESTERASE INHIBITION IN, THE SHEEPSHEAD MINNOW, /CYPRINODON VARIEGATUS/. Trans. Am. Fish. Soc. 108 (5): 479-488. Sept. 1979. SFA 25(1)
[U.S. EPA, Environ. Res. Lab., Gulf Breeze, FL 32561]

80-000624 Han, J. C-Y. RESIDUE STUDIES WITH (^{14}C) FOSAMINE AMMONIUM IN CHANNEL CATFISH. J. Toxicol. Environ. Health 5 (5): 957-963. Sept. 1979. SFA 25(1)
[Biochem. Dep., Exp. Stn., E.I. duPont de Nemours & Co., Inc., Wilmington, DE] The active ingredient in du Pont Krenite brush control agent is ammonium ethyl carbamoylphosphonate (fosamine ammonium salt, formerly known as DPX-1108). Residues in channel catfish exposed to 1.1 ppm ^{14}C-carbonyl-labeled fosamine ammonium in water for 4 wk were found to plateau in 2-3 wk with an accumulation factor (ration of residue in fish to residue in water) of less than 1. In a separate experiment, channel catfish were placed for 4 wk in a tank containing (^{14}C)fosamine ammonium-treated soil (15 ppm) that had been aged for 30 d prior to flooding and initiation of fish exposure. The residue levels in this latter group of catfish also plateaued in 2-3 wk with an accumulation factor of less than 1. In both experiments, after the 4-wk exposures, the fish were transferred to fresh water for 2-wk depuration periods, during which residue levels dropped 50-90 percent. No effects on the fish were observed during these experiments.

80-000625 Hawryshyn, C. W.; Mackay, W. C. TOXICITY AND TISSUE UPTAKE OF METHYLMERCURY ADMINISTERED INTRAPERITONEALLY TO RAINBOW TROUT (/SALMO GAIRDNERI/ RICHARDSON). Bull. Environ. Contam. Toxicol. 23 (1/2): 79-86. Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

80-000626 Henry, M. G.; Atchison, G. J. INFLUENCE OF SOCIAL RANK ON THE BEHAVIOUR OF BLUEGILL, /LEPOMIS MACROCHIRUS/ RAFINESQUE EXPOSED TO SUBLETHAL CONCENTRATIONS OF CADMIUM AND ZINC. J. Fish Biol. 15 (3): 309-315. Sept. 1979. SFA 25(1)
[Dep. Anim. Ecol., Iowa State Univ., Ames 50011] The influence of social rank on changes in /Lepomis macrochirus/ behaviour brought about by exposure to sublethal concentrations of cadmium and zinc was studied. Significant changes occurred in the frequency of eight of the nine behavioural acts quantified. The effects of metals on the behaviour of individuals was often related to the individual's social status in the hierarchies that had formed. The majority of agonistic behaviours (nips and nudges) were performed by dominant individuals and the majority of comfort behaviours (coughs, yawns, jerks, jerk swimming, fin flickering and chafes) occurred in subordinate individuals. These differences occurred during the control period as well as the treatment period and are thought to be in part caused by socially induced stress.

80-000627 Hodson, P. V. METERING DEVICE FOR TOXICANTS USED IN BIOASSAYS WITH AQUATIC ORGANISMS. Prog. Fish-Cult. 41 (3): 129-131. July 1979. SFA 25(1)
[Great Lakes Biolimnol. Lab., Canada Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

80-000628 Iwama, G. K.; Greer, G. L. TOXICITY OF SODIUM PENTACHLOROPHENATE TO JUVENILE CHINOOK SALMON UNDER CONDITIONS OF HIGH LOADING DENSITY AND CONTINUOUS-FLOW EXPOSURE. Bull. Environ. Contam. Toxicol. 23 (4/5): 711-716. Nov. 1979. SFA 25(1)
[Minist. Recreation Conserv., Fish Wildl. Br., 400-1019 Wharf St., Victoria, BC V8W 2Y9, Canada]

80-000629 Jay, F. B.; Muncy, R. J. TOXICITY TO CHANNEL CATFISH OF WASTEWATER FROM AN IOWA COAL BENEFICIATION PLANT. Iowa State J. Res. 54 (1): 45-50. Aug. 1979. SFA 25(1)
[Water Treatment Plant, Ventura, CA 93003] Chemical analyses by Inductively Coupled Plasma, multielement Optical Emission Spectroscopy for 30 major cations in a closed, coal-washing, wastewater system revealed only mercury approaching levels considered acutely toxic to fish judging by published toxicity data. In two of five 96-hour static tests, mortalities were recorded for fingerling channel catfish (/Ictalurus punctatus/) exposed to high concentrations of wastewater. Mortalities were recorded also in two series by use of pH-altered reconstituted water to which finely ground coal had been added to simulate levels of settleable solids found in coal-cleaning wastewater. Mortality of fingerling channel catfish was interrelated with high concentrations of settleable solids, pH below 4.5, and lowered dissolved oxygen concentrations.

80-000630 Johnson, A. G.; Williams, T. D.; Messinger, J. F. III; Arnold, C. R. LARVAL SPOTTED SEATROUT (/CYNOSCION NEBULOSUS/) A BIOASSAY SUBJECT FOR THE MARINE SUBTROPICS. Contrib. Mar. Sci. 22: 57-62. Aug. 1979. SFA 25(1)
[NMFS, Panama City, FL 32407] Larval spotted sea trout were selected as the test subject because specimens can be produced under laboratory conditions throughout the year by adjusting the temperature and photoperiod. Tests were made to determine the sensitivity of spotted sea trout larvae to water samples from different environments and to Baton Rouge No. 2 fuel oil. Considerable variation in water quality was found within a small area with regard to larval mortality. Sublethal fuel oil concentrations (0.00-1.00 ppm) produced a general decrease in total body length and critical distance. An increase in unpigmented eyes occurred with an increase in fuel oil concentrations.

80-000631 Khangarot, B. S.; Rajbanshi, V. K. EXPERIMENTAL STUDIES ON TOXICITY OF ZINC TO A FRESHWATER TELEOST, /RASBORA DANICONIUS/ (HAMILTON). Hydrobiologia 65 (2): 141-144. 17 Aug. 1979. SFA 25(1)
[Dr. V. K. Rajbanshi: Dep. Limnol. Fish., Univ. Udaipur, Udaipur 313001, India] /Rasbora daniconius/ (Ham.) were exposed to zinc sulphate up to 15 days under static bioassay test conditions with renewal of the test solutions every 24 hours. Simultaneously control fish were also kept in water without zinc. The 96 and 240 hr LC(50) values were 38.1 and 33.3 ppm of zinc respectively. A reduced mortality rate was observed after 96 hr and LC(50) approached a constant value at 240 hr of exposure to the toxicant. Fish showed abnormal behaviour, deposition of mucus and appearance of haemorrhage on the body in case of higher concentrations of zinc, before death. The reported LC(50) values in the present study were comparatively higher than those reported by earlier investigators.

80-000632 Kincheloe, J. W.; Wedemeyer, G. A.; Koch, D. L. TOLERANCE OF DEVELOPING SALMONID EGGS AND FRY TO NITRATE EXPOSURE. Bull. Environ. Contam. Toxicol. 23 (4/5): 575-578. Nov. 1979. SFA 25(1)
[U.S. FWS, Div. Ecol. Serv., 727 N.E. 24th Ave., Portland, OR 97232]

80-000633 Kocan, R. M.; Landolt, M. L.; Sabo, K. M. /IN VITRO/ TOXICITY OF EIGHT MUTAGENS/CARCINOGENS FOR THREE FISH CELL LINES. Bull. Environ. Contam. Toxicol. 23 (1/2): 269-274. Sept. 1979. SFA 25(1)
[Dep. Pathol., SM-30, Univ. Wash., Seattle 98185]

80-000634 Leung, T. S.; Bulkley, R. V. EFFECTS OF PETROLEUM HYDROCARBONS ON LENGTH OF INCUBATION AND HATCHING SUCCESS IN THE JAPANESE MEDAKA. Bull. Environ. Contam. Toxicol. 23 (1/2): 236-243. Sept. 1979. SFA 25(1)
[11 Science Hall II, Iowa State Univ., Ames 50011]

80-000635 Lorz, H. W.; Glenn, S. W.; Williams, R. H.; Kunkel, C. M.; Norris, L. A.; Loper, B. R. EFFECTS OF SELECTED HERBICIDES ON SMOLTING OF COHO SALMON. U. S. Environ. Prot. Agency Res. Rep. Ser. EPA-600/3-79-071. xi + 103p. June 1979. SFA 25(1)
[Oreg. Dep. Fish Wildl., Corvallis 97331]

80-000636 Masri, M. S.; Hendricks, J. D.; Sinnhuber, R. O. AFLATOXIN Q(1)-MAJOR DETOXIFYING PATHWAY IN PRIMATES, CARCINOGENICITY TESTS IN RAINBOW TROUT. Toxicon 17 (suppl. 1): 116-117. 1979. SFA 25(1)
[West. Reg. Res. Lab., USDA, SEA, Berkeley, CA 94710]

80-000637 Mathur, D. S. HISTOPATHOLOGICAL CHANGES IN THE LIVER OF FISH RESULTING FROM EXPOSURE TO CERTAIN INSECTICIDES. Toxicon 17 (suppl. 1): 188. 1979. Abstract only. SFA 25(1)
[Zool. Surv. India, Jabalpur (U.P.), India]

80-000638 McDonald, T. O. COMPARISON OF THE EFFECTS OF PARATHION AND DDT ON THE CONCENTRATIONS OF SEROTONIN, NOREPINEPHRINE AND DOPAMINE IN THE BRAIN AND RETINA/PIGMENT EPITHELIUM/CHOROID OF THE GOLDFISH. Ph.D. dissertation, Tulane Univ. 105p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(3):1073. Sept. 1979. SFA 25(1)

80-000639 McLeay, D. J.; Munro, J. R. PHOTOPERIODIC ACCLIMATION AND CIRCADIAN VARIATIONS IN TOLERANCE OF JUVENILE RAINBOW TROUT (/SALMO GAIRDNERI/) TO ZINC. Bull. Environ. Contam. Toxicol. 23 (4/5): 552-557. Nov. 1979. SFA 25(1)
[Div. Appl. Biol., B.C. Research, 3650 Wesbrook Mall, Vancouver, BC V6S 2L2, Canada]

80-000640 McLeay, D. J.; Brown, D. A. STRESS AND CHRONIC EFFECTS OF UNTREATED AND TREATED BLEACHED KRAFT PULPMILL EFFLUENT ON THE BIOCHEMISTRY AND STAMINA OF JUVENILE COHO SALMON (/ONCORHYNCHUS KISUTCH/). J. Fish. Res. Board Can. 36 (9): 1049-1059. Sept. 1979. In English with French summ. SFA 25(1)
[Div. Appl. Biol., B.C. Research, Vancouver, BC V6S 2L2, Canada]

80-000641 Miller, R. A.; Norris, L. A.; Loper, B. R. THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-/P/-DIOXIN (TCDD) IN WATER. Trans. Am. Fish. Soc. 108 (4): 401-407. July 1979. SFA 25(1)
[U.S. For. Serv., Pac. Northwest For. Range Exp. Stn., For. Sci. Lab., Corvallis, OR 97331]

80-000642 Moles, A.; Rice, S. D.; Korn, S. SENSITIVITY OF ALASKAN FRESHWATER AND ANADROMOUS FISHES TO PRUDHOE BAY CRUDE OIL AND BENZENE. Trans. Am. Fish. Soc. 108 (4): 408-414. July 1979. SFA 25(1)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

80-000643 Moshkov, D. A.; Tiras, N. R.; Miroshnikov, A. I. EFFECT OF APAMINE ON THE ULTRASTRUCTURE OF MAUTHNER'S NEURONS IN FISH. Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR Ser. Biol.) 245: 851-853. Sept. 1979. SFA 25(1)
[Inst. Biol. Phys., Acad. Sci., USSR, Pushcino, Moscow Region, USSR]

80-000644 Narbonne, J. F.; Gallis, J. L. /IN VIVO/ AND /IN VITRO/ EFFECT OF PHENOCLOR DP6 ON DRUG METABOLIZING ACTIVITY IN MULLET LIVER. Bull. Environ. Contam. Toxicol. 23 (3): 338-343. Oct. 1979. SFA 25(1)
[Lab. Physiol. Nutr., Univ. Bordeaux 1, F 33405 Talence, France]

80-000645 Parkhurst, B. R.; Bradshaw, A. S.; Forte, J. L.; Wright, G. P. AN EVALUATION OF THE ACUTE TOXICITY TO AQUATIC BIOTA OF A COAL CONVERSION EFFLUENT AND ITS MAJOR COMPONENTS. Bull. Environ. Contam. Toxicol. 23 (3): 349-356. Oct. 1979. SFA 25(1)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

80-000646 Pfeifer, K. F.; Weber, L. J. THE EFFECT OF CARBON TETRACHLORIDE ON THE TOTAL PLASMA PROTEIN CONCENTRATION OF RAINBOW TROUT, /SALMO GAIRDNERI/. Comp. Biochem. Physiol. C Comp. Pharmacol. 64 (1): 37-42. 1979. SFA 25(1)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331] The effect of a single i.p. injection of CCl(4) on total plasma protein and albumin concentrations was measured in the rainbow trout. CCl(4) treatment caused a significant reduction in total plasma protein concentration at 12, 24 and 36 hr post-treatment. At 24 hr post-treatment plasma albumin concentration was significantly reduced only in fish given the highest dose of CCl(4) (2.0 ml/kg). Several factors, including intestinal inflammation and hemorrhages, could have contributed to the decreased plasma protein concentration in the trout.

80-000647 Post, G. CARBONIC ACID ANESTHESIA FOR AQUATIC ORGANISMS. Prog. Fish-Cult. 41 (3): 142-144. July 1979. SFA 25(1)
[Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins 80523]

80-000648 Redner, B. D.; Stickney, R. R. ACCLIMATION TO AMMONIA BY /TILAPIA AUREA/. Trans. Am. Fish. Soc. 108 (4): 383-388. July 1979. SFA 25(1)
[Dep. Biol., Memphis State Univ., Memphis, TN 38152]

80-000649 Roch, M.; Maly, E. J. RELATIONSHIP OF CADMIUM-INDUCED HYPOCALCEMIA WITH MORTALITY IN RAINBOW TROUT (/SALMO GAIRDNERI/) AND THE INFLUENCE OF TEMPERATURE ON TOXICITY. J. Fish. Res. Board Can. 36 (11): 1297-1303. Nov. 1979. In English with French summ. SFA 25(1)
[Dep. Biol., Concordia Univ., Montreal, PQ H3G 1M8, Canada]

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[RMC Ecol. Div., Muddy Run Lab., P.O. Box 10, Drumore, PA 17518] The toxicity of un-ionized ammonia (NH(3)-N) to spotfin shiner, /Notropis spilopterus/, 31-85 mm total length was determined in two tests 25.5 C. The resultant 96-hour TL(50) values were 1.0 to 1.3 mg/l unionized ammonia; TL(50) was 1.17 mg/l for the combined data. Results of this and other studies indicate that TL(50) values of warmwater species are higher than those of cold water species. Findings of this study may be applicable for development of ammonia discharge criteria for warmwater environments.

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[Holkars Sci. Coll., Dep. Zool., Indore, India]

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[Inst. Fish. Biol., Univ. Bergen, Nordnesparken 2a, 5011 Bergen/Nordnes, Norway]

80-000656 Takeda, M.; Ueda, T. ACCUMULATION OF MERCURY AND SELENIUM IN CULTURED YELLOWTAIL. Bull. Jpn. Soc. Sci. Fish. 45 (7): 901-904. July 1979. In Japanese with English summ. SFA 25(1)
[Dep. Food Sci. Technol., Shimonoseki Univ. Fish., Shimonoseki 759-65, Japan]

80-000657 Tomasso, J. R.; Simco, B. A.; Davis, K. B. CHLORIDE INHIBITION OF NITRITE-INDUCED METHEMOGLOBINEMIA IN CHANNEL CATFISH (/ICTALURUS PUNCTATUS/). J. Fish. Res. Board Can. 36 (9): 1141-1144. Sept. 1979. In English with French summ. SFA 25(1)
[Ecol. Res. Cent., Dep. Biol., Memphis State Univ., Memphis, TN 38152]

80-000658 Tsai, C. SURVIVAL, OVERTURNING AND LETHAL EXPOSURE TIMES FOR THE PEARL DACE, /SEMOTILUS MARGARITUS/ (COPE), EXPOSED TO COPPER SOLUTION. Comp. Biochem. Physiol. C Comp. Pharmacol. 64 (1): 1-6. 1979. SFA 25(1)
[Cent. Environ. Estuarine Stud., Univ. Md., College Park 20742]
Pearl dace were exposed to copper solutions at concentrations of 1.01, 9.25, 73.7 and 279 mg/l for periods of up to 420 min and then transferred to clean water. Survival, overturning and lethal exposure times of fish decreased as exposure time increased at each concentration. The median lethal exposure time was shorter than the median overturning time and much shorter than the median survival

80-000658 CONTINUED
time, suggesting that the fish had received a lethal dose of copper before they overturned. The overturning period for fish overturned and killed in copper solutions averaged 10.9 min and was independent of exposure time, survival time and copper concentration. For those fish overturned and killed after being transferred to clean water, the overturning period increased as survival time increased.

80-000659 Uviovo, E. J.; Beatty, D. D. EFFECTS OF CHRONIC EXPOSURE TO ZINC ON REPRODUCTION IN THE GUPPY (/POECILIA RETICULATA/). Bull. Environ. Contam. Toxicol. 23 (4/5): 650-657. Nov. 1979. SFA 25(1)
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80-000660 Van den Berg, C. M. G.; Wong, P. T. S.; Chau, Y. K. MEASUREMENT OF COMPLEXING MATERIALS EXCRETED FROM ALGAE AND THEIR ABILITY TO AMELIORATE COPPER TOXICITY. J. Fish. Res. Board Can. 36 (8): 901-905. Aug. 1979. In English with French summ. SFA 25(1)
[Geol. Dep., McMaster Univ., Hamilton, ON L8S 4M1, Canada]

80-000661 Varanasi, U.; Gmur, D. J.; Treseler, P. A. INFLUENCE OF TIME AND MODE OF EXPOSURE ON BIOTRANSFORMATION OF NAPHTHALENE BY JUVENILE STARRY FLOUNDER (/PLATICHTHYS STELLATUS/) AND ROCK SOLE (/LEPIDOPSETTA BILINEATA/). Arch. Environ. Contam. Toxicol. 8 (6): 673-692. 1979. SFA 25(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-000662 Voyer, R. A.; Heltsche, J. F.; Kraus, R. A. HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, /MENIDIA MENIDIA/ (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES. Bull. Environ. Contam. Toxicol. 23 (4/5): 475-481. Nov. 1979. SFA 25(1)
[U.S. EPA, South Ferry Rd., Narragansett, RI 02882]

80-000663 Yamagishi, T.; Akiyama, K.; Morita, M.; Takahashi, R.; Miyazaki, T.; Kaneko, S. DETERMINATION METHOD FOR RESIDUAL 1,3-DICHLORO- AND 1,3,5-TRICHLORO-2-(4-NITROPHENOXY) BENZENE (NIP AND CNP) IN FISH AND SHELLFISH. Bull. Environ. Contam. Toxicol. 23 (1/2): 57-63. Sept. 1979. SFA 25(1)
[Tokyo Metro. Res. Lab. Public Health, 3-24-1, Hyakunin-cho, Shinjiku-ku, Tokyo, 160 Japan]

FISH TOXICANTS

80-000664 Chandler, J. H., Jr.; Marking, L. L. TOXICITY OF FISHERY CHEMICALS TO THE ASIATIC CLAM, /CORBICULA MANILENSIS/. Prog. Fish-Cult. 41 (3): 148-151. July 1979. SFA 25(1)
[U.S. FWS, P.O. Box 9, Warm Springs, GA 31830]

80-000665 Engstrom-Heg, R.; Colesante, R. T. PREDICTING ROTENONE DEGRADATION IN LAKES AND PONDS. N.Y. Fish Game J. 26 (1): 22-36. Jan. 1979. SFA 25(1)
The rate of natural degradation of rotenone in a lake was estimated by suspending rotenone solutions at a series of depths in clear and opaque plastic bags. Logarithms of rate constants for all deep samples and for surface and epilimnetic samples in opaque bags were proportional to temperature, with degradation occurring more slowly than was estimated by Post (1958). Detoxification of surface samples in clear bags was in good agreement with Post's findings, indicating that light plays an important role in detoxification of surface waters. Equations were developed for estimating detoxification times and appropriate treatment dates in relation to the fall overturn for lakes and ponds under a variety of conditions.

RESEARCH AND MANAGEMENT-GENERAL

80-000666 Dahlberg, M. L. HISTORY OF THE FISHERY AND SUMMARY STATISTICS OF THE SOCKEYE SALMON, /ONCORHYNCHUS NERKA/, RUNS TO THE CHIGNIK LAKES, ALASKA, 1888-1966. NOAA Tech. Rep. NMFS SSRF- 735. iv + 16p. Aug. 1979. SFA 25(1)
[NMFS, Box 155, Auke Bay, AK 99821] Annual runs of sockeye salmon to the Chignik Lakes, Alaska, decreased from an average of 1.9 million during the period 1922-39 to an average of 0.9 million during the period 1949-66. In order to study the dynamics of the runs' historic catch, escapement and age structure data were compiled by spawning stock and brood year. The history of fishing and management of the runs from inception of the fishery until 1966 is described. The high seas and coastal distributions of Chignik sockeye salmon indicated significant interception by the fishery in only one area other than the Chignik Bay and Chignik Lagoon; the fishery at Cape Igvak started in the mid-1960's. Results of the study were used to construct parent-progeny relationships that formed the basis for a management strategy to restore the runs to their former level of abundance.

80-000667 FAO of the UN REPORT OF THE TENTH SESSION OF THE EUROPEAN INLAND FISHERIES ADVISORY COMMISSION. HAMBURG, 20-27 JUNE 1978. FAO Fish. Rep. No. 219. vi + 62p. 1979. SFA 25(1)
[Rome, Italy]

80-000668 Grant, B. F.; Putz, R. E.; Hutton, R. F.; Dillard, J. G.; Kirkland, L. A.; Regier, H. A. STATUS OF CURRENT RESEARCH IN FISHERIES. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 157-165. 1979. SFA 25(1)
[U.S. FWS, Natl. Fish Health Res. Lab., Kearneysville, WV]

80-000669 Landry, J. L.; Hirsch, L. P.; McCaffrey, E. R. A RATING SYSTEM FOR THREATENED AND ENDANGERED SPECIES OF WILDLIFE. N.Y. Fish Game J. 26 (1): 11-21. Jan. 1979. SFA 25(1)
A rating system for systematically determining the relative status of native wildlife species and for assessing the likelihood that the potential for survival of a threatened or endangered species can be enhanced by the efforts of a wildlife agency is described. The status index is derived from graded evaluations under a degree of threat factor, a regional uniqueness factor and a social-ecological-economic factor. The program success index is derived from the status index and a recovery potential factor. The evaluations to be applied under each

80-000669 CONTINUED
factor are defined and given numerical values that can then be used in equations to yield comparable ratings. The status and program indices, considered in conjunction with the required actions and estimated costs of an effective management effort, provide the basis for developing a comprehensive, justifiable and effective endangered species program.

80-000670 Lynch, J. T. THE ROLE OF LAW ENFORCEMENT IN NEW YORK FISHERIES MANAGEMENT. Fisheries (Bull. Am. Fish. Soc.) 4 (5): 2, 4-6. Sept.-Oct. 1979. SFA 25(1)

80-000671 Maher, F. P. THE SPORT FISHERY FUTURE IN ONTARIO. Ont. Fish Wildl. Rev. 18 (1): 24-28. 1979. SFA 25(1)

80-000672 McMinds, G. R. THE NORTHWEST FISHING RIGHTS CONTROVERSY: AN INDIAN PERSPECTIVE. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 604-617. 1979. SFA 25(1)
[Northwest Indian Fish. Comm., Quinalt Treaty Area, Taholah, WA]

80-000673 Moyle, P. B.; Andrews, R. E.; Jenkins, R. M.; Noble, R. L; Saila, S. B.; Wick, W. O. RESEARCH NEEDS IN FISHERIES. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 176-187. 1979. SFA 25(1)
[Dep. Wildl. Fish. Biol., Univ. Calif., Davis]

80-000674 Nicholas, D. VIEW OF THE NATIONAL INDIAN BROTHERHOOD OF CANADA. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 601-603. 1979. SFA 25(1)
[Natl. Indian Brotherhood, Ottawa, ON, Canada]

80-000675 Smith, S. C.; Cross, G. H.; Chapman, D. R.; Farris, A. L.; Stroud, R. H. ASSESSMENT OF PROBLEMS IN FISH AND WILDLIFE RESEARCH. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 143-147. 1979. SFA 25(1)
[Sch. Nat. Resour., Univ. Wis., Madison]

80-000676 Stansby, M. E. FEDERAL FISHERY RESEARCH IN THE PACIFIC NORTHWEST PRECEDING FORMATION OF NORTHWEST FISHERIES CENTER. U.S. Dep. Commer. Natl. Mar. Fish. Serv. 35p. Nov. 1979. SFA 25(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-000677 Thompson, T. P. JOB SATISFACTION AMONG FISHERIES PROFESSIONALS: A REPORT TO THE SAMPLE. Fisheries (Bull. Am. Fish. Soc.) 4 (4): 7-13. July-Aug. 1979. SFA 25(1)
[Dep. Sociol., Queens Coll., Charlotte, NC]

80-000678 Walker, H. INDIAN HUNTING AND FISHING RIGHTS. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 618-619. 1979. SFA 25(1)
[U.S. Dep. Inter., Washington, DC]

ADMINISTRATION AND PLANNING

80-000679 Edwards, W. R.; Hale, J. B.; Timmerman, J. A., Jr.; Youatt, W. G.; Doig, H. THE ROLE OF STATE AGENCIES IN FISH AND WILDLIFE RESEARCH. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 197-208. 1979. SFA 25(1)
[Sect. Wildl. Res., Ill. Nat. Hist. Surv., Urbana]

80-000680 Hoekstra, T. W.; Schweitzer, D. L.; Cushwa, C. T.; Anderson, S. H.; Barnes, R. D. PRELIMINARY EVALUATION OF A NATIONAL WILDLIFE AND FISH DATA BASE. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 380-391. 1979. SFA 25(1)
[USDA, For. Serv., Fort Collins, CO]

80-000681 Labisky, R. F.; Klimstra, W. D.; Gray, J. L.; Jahn, L. R.; Sullivan, C. R.; Zagata, M. D. ENABLING MECHANISMS FOR THE SUPPORT OF FISH AND WILDLIFE RESEARCH AT ACADEMIC INSTITUTIONS. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 217-222. 1979. SFA 25(1)
[Sch. For. Resour. Conserv., Univ. Fla., Gainesville]

80-000682 Loveless, C. M.; Crawford, J. E.; Jones, C.; Linn, R.; Ripley, T.; Smith, D. R. THE ROLE OF FEDERAL AGENCIES IN FISH AND WILDLIFE RESEARCH. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 188-196. 1979. SFA 25(1)
[For. Environ. Res., USDA, For. Serv., Washington, DC]

80-000683 McGaw, R. L.; Sinclair, W. F. COMMENT ON MANAGEMENT ALTERNATIVES AND STRATEGIC PLANNING FOR CANADA'S FISHERIES. J. Fish. Res. Board Can. 36 (11): 1417-1418. Nov. 1979. In English with French summ. SFA 25(1)
[Dep. Econ., Univ. New Brunswick, Fredericton, NB E3B 5A3, Canada]

80-000684 Weller, M. W.; Kevern, N. R.; Peterle, T. J.; Progulske, D. R.; Teer, J. G.; Tubb, R. A. ROLE OF UNIVERSITIES IN FISH AND WILDLIFE RESEARCH. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 209-216. 1979. SFA 25(1)
[Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul]

REPORTS OF FISHERY STATIONS, STATES, ETC.

80-000685 Anonymous REPORT ON THE SEA AND INLAND FISHERIES OF NORTHERN IRELAND 1978. Northern Ireland Dep. Agric. 27p. 1979. SFA 25(1)
[Northern Ireland Dep. Agric., Belfast, Northern Ireland]

80-000686 FAO of the UN GENERAL FISHERIES COUNCIL FOR THE MEDITERRANEAN. REPORT OF THE FOURTEENTH SESSION NANTES, FRANCE, 16-20 OCTOBER 1978. Gen. Fish. Counc. Mediterr. 14: 42p. 1978. SFA 25(1)
[Rome, Italy]

80-000687 Fisheries and Environment Canada ANNUAL REPORT 1977/1978. Fish. Environ. Can. 67p. 1979.
[Ottawa K1A 0H3, Canada]
[Ottawa K1A 0H3, Canada]

HABITAT ALTERATION

80-000688 Bacon, J. R.; Maas, R. P. CONTAMINATION OF GREAT SMOKY MOUNTAINS TROUT STREAMS BY EXPOSED ANAKEESTA FORMATIONS. J. Environ. Qual. 8 (4): 538-543. Oct.-Dec. 1979. SFA 25(1)
[Dep. Chem., West. Carolina, Univ., Cullowhee, NC 38723] Anakeesta formations, prevalent geologic deposits in the Great Smoky Mountains National Park (GSMNP), when exposed to air and water release an acid and heavy metal containing leachate into several GSMNP streams, rendering them virtually lifeless. Anakeesta pyrite affecting Beech Flats Creek was exposed during the construction of U.S. Highway 441, while exposures affecting Alum Cave Creek and Walker Prong are naturally occurring. The road cut on U.S. 441 at Beech Flats Creek acts as point source of various contaminants. The acidity increases 100-fold (pH 6.7 to 4.7) in the several hundred meters where the stream flows through a road cut fill area. Manganese and zinc were the main metallic ions introduced at the road cut. The zinc increased from 6 to nearly 200 ppb and the manganese increased from an undetectable level to over 250 ppb. Seasonal variations below the road show a high concentration near 500 ppb in the summer to a low concentration near 100 ppb in the winter for both manganese and zinc. Both manganese and zinc showed the dilution effect expected going downstream away from the road cut. Alum Cave Creek and Walker Prong showed much lower levels of manganese and zinc and no point source could be located. The results of the present study should prove useful to National Park personnel in making management decisions. This is especially important in view of several proposed new roads in the Great Smoky Mountains National Park.

80-000689 Ditton, R. B.; Graefe, A. R.; Fedler, A. J.; Schwartz, J. D. ACCESS TO AND USAGE OF OFFSHORE LIBERTY SHIP REEFS IN TEXAS. Mar. Fish. Rev. 41 (9): 25-31. Sept. 1979. SFA 25(1)
[Dep. Recreation Parks, Tex. A&M Univ., College Station 77843] Although artificial reefs have been deployed to increase fish stocks in the United States for over a century, few studies have been done to evaluate the benefits of such reefs. This study seeks to identify the extent to which the Texas Liberty Ship reefs are used by recreational fisherman. Two independent surveys were used to address the two principal means of gaining access to Liberty Ship reefs. One study focused on the Texas charter and party boat fleet and the other on private boat fishermen residing in the Houston-Galveston metropolitan area. The Liberty Ship reefs were found to attract a substantial number of private boat and charter/party boat fishermen, especially when the extent of use is compared with other site-specific artificial or natural offshore attractions. Nearly all use of the Liberty Ship reefs originated from the closest access point. Use of a particular reef site appears to be related to the availability of alternative fishing grounds and the capability to travel great distances offshore.

80-000690 Graynoth, E. EFFECTS OF LOGGING ON STREAM ENVIRONMENTS AND FAUNAS IN NELSON. N.Z. J. Mar. Freshwater Res. 13 (1): 79-109. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand]

80-000691 Parker, R. O., Jr.; Stone, R. B.; Buchanan, C. C. ARTIFICIAL REEFS OFF MURRELLS INLET, SOUTH CAROLINA. Mar. Fish. Rev. 41 (9): 12-24. Sept. 1979. SFA 25(1)
[NMFS, Beaufort, NC 28516] Between the spring of 1971 and the summer of 1974, the benthic community of reefs constructed of vessels and tires in 35 feet (11 m) of water off Murrells Inlet, S.C., was studied by scuba divers. Sixty-three species representing 33 families were observed; the most frequently encountered species were: black sea bass, /Centropristis striata/; longspine porgy, /Stenotomus caprinus/; pinfish, /Lagodon rhomboides/; spottail pinfish, /Diplodus holbrooki/; pigfish, /Orthopristis chrysoptera/; tomtate, /Haemulon aurolineatum/; scad, /Decapterus/ sp.; Atlantic spadefish, /Chaetodipterus faber/; cubbyu, /Equetus umbrosus/; Carolina hake, /Urophycis earlii/; sheepshead, /Archosargus probatocephalus/; and summer flounder, /Paralichthys dentatus/. Some species resided on the reefs throughout the year but fluctuated in abundance with the seasons; others were seasonal residents. Several species inhabited specific areas of the reefs. In the summer and fall, tropical fishes occupied the reefs but they rarely over-wintered. In the winter there were fewer species of fish but larger individuals.

80-000692 Smith, G. B.; Hensley, D. A.; Mathews, H. H. COMPARATIVE EFFICACY OF ARTIFICIAL AND NATURAL GULF OF MEXICO REEFS AS FISH ATTRACTANTS. Fla. Dep. Nat. Resour. Mar. Res. Lab. Res. Publ. No. 35. 7p. June 1979. SFA 25(1)
[Fla. Dep. Nat. Resour., Mar. Res. Lab., 100 8th Ave. SE, St. Petersburg 33701] Fish communities at artificial and natural reefs off west-central Florida were studied and described. Artificial reefs consisting of automobile tires and concrete culvert harbored an ichthyofauna considered qualitatively identical to that of nearby natural reefs. Fish density was greatest over artificial substrates, probably due to their greater structural complexity. Relative species abundance varied according to reef type.

80-000693 Stone, R. B.; Pratt, H. L.; Parker, R. O., Jr.; Davis, G. E. A COMPARISON OF FISH POPULATIONS ON AN ARTIFICIAL AND NATURAL REEF IN THE FLORIDA KEYS. Mar. Fish. Rev. 41 (9): 1-11. Sept. 1979. SFA 25(1)
[NMFS, Washington, DC 20235] An artificial reef was placed adjacent to a natural coral patch reef of similar size to study the feasibility of increasing fish carrying capacity and total biomass with in a given area by augmenting natural reef habitat. After the artificial reef had been in place 7 months, visual observations indicated about equal numbers of fishes and similar species composition on both the artificial reef and the natural patch reef. Although the artificial reef was less than 25 m from the natural reef, but it did not diminish the resident populations of the natural reef, but doubled the carrying capacity and fish biomass in the immediate vicinity of the two reefs. For the remaining 2 years of this study, the fish populations on both reefs showed similar seasonal fluctuations.

80-000694 Van Dolah, R. F.; Calder, D. R.; Knott, D. M.; Maclin, M. S. EFFECTS OF DREDGING AND UNCONFINED DISPOSAL OF DREDGED MATERIAL ON MACROBENTHIC COMMUNITIES IN SEWEE BAY, SOUTH CAROLINA. S.C. Mar. Resour. Cent. Tech. Rep. No. 39. 54p. Apr. 1979. SFA 25(1)
[Mar. Resour. Cent., S.C. Wildl. Mar. Resour. Dep., Charleston 29412]

HARVEST, CREEL CENSUS

80-000695 Bell, F. W. RECREATIONAL VERSUS COMMERCIAL FISHING IN FLORIDA: AN ECONOMIC IMPACT ANALYSIS. Fla. State Univ., Policy Sci. Prog. iii + 26p. 30 Apr. 1979. SFA 25(1)

80-000696 Farr, D. M.; Blake, L. M. A CREEL CENSUS OF THE SALMONID FISHERY IN SOUTH SANDY CREEK, NEW YORK. N.Y. Fish Game J. 26 (1): 1-10. Jan. 1979. SFA 25(1)
A creel census of the salmonid fishery (primarily for chinook salmon) in South Sandy Creek (N.Y.) was conducted in the fall of 1976 to determine fishing pressure, number of fish taken and catch rate. A total of 3,266 anglers spent 9,066 hours fishing the 6.75-mile study section during the 44-day census period. Fishing pressure on weekends and holidays differed significantly from that on weekdays. Fish caught totalled 5,469 for a catch rate of 0.6 per hour for all anglers and 1.06 per hour for successful anglers. Chinook salmon constituted 96 percent of the catch. Just prior to the start of the census, possession of any salmon was prohibited due to Mirex contamination. Nevertheless, substantial fishing pressure was observed indicating the importance of the fishery for sport fishing alone, although a dramatic increase did follow the later relaxation of the ban. It is pointed out that the data reflect a fishery under unique controls and do not represent typical conditions.

80-000697 Gustaveson, A. W.; Stowell, F. M.; Hepworth, D. K. A REVIEW OF FISHING SUCCESS AND PRESSURE ON LAKE POWELL 1964-1976. Utah State Div. Wildl. Resour. Publ. No. 79-4. ii + 24p. 1979. SFA 25(1)
[Utah Div. Wildl. Resour., Salt Lake City] Creel census at four access areas on Lake Powell between 1964-1976 resulted in over 41,500 interviews. Total boat use increased fivefold while fishing pressure doubled. Over half of the anglers interviewed resided in Arizona. Average catch rate for all species of fish was 0.56 fish/hr. Catch rates appeared depressed in areas of high fishing pressure. Species composition of the creel for the total period was 47 percent largemouth bass, 25 percent black crappie and 28 percent other species.

80-000698 Lenanton, R. C. J. THE INSHORE-MARINE AND ESTUARINE LICENSED AMATEUR FISHERY OF WESTERN AUSTRALIA. West. Aust. Mar. Res. Lab. Fish. Res. Bull. No. 23. 33p. 1979. SFA 25(1)
[Dep. Fish. Wildl., Perth, Western Australia]

80-000699 Smith, J. E. CATCH AND EFFORT STATISTICS OF THE CANADIAN GROUNDFISH FISHERY ON THE PACIFIC COAST IN 1978. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 891. iv + 82p. July 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]
Catch and effort statistics for the Canadian groundfish fishery (excluding halibut) on the Pacific coast in 1978 are presented. Statistics are shown by major and minor statistical areas by month, in both pounds and metric tons. Total landing in 1978 were 70 million lb (27.233 m.t.), an increase of 15 percent from 1977. The bulk (86 percent) of the catch was taken by trawl gear. The main species landed were Pacific cod, various rockfish species, pollock and turbot.

80-000700 Spenard, P. LA PECHE AU HARENG AUX ILES-DE-LA-MADELEINE, 1900-1978. [THE FISHERY FOR HERRING AT MAGDALEN ISLANDS, 1900-1978.] Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 876. x + 84p. May 1979. In French with English summ. SFA 25(1)
[Minist. Fish. Oceans, 901, Cap Diamant, Quebec, PQ, Canada]

80-000701 Warren, J. P.; Griffin, W. L. GROUNDFISH TRAWLER PROFITABILITY, NORTHERN GULF OF MEXICO. Mar. Fish. Rev. 41 (8): 15-22. Aug. 1979. SFA 25(1)
[Dep. Agric. Econ., Tex. A&M Univ., College Station 77843]

80-000702 Yuen, H. S. H. A NIGHT HANDLINE FISHERY FOR TUNAS IN HAWAII. Mar. Fish. Rev. 41 (8): 7-14. Aug. 1979. SFA 25(1)
[NMFS, Honolulu, HI 96812]

REGULATIONS

80-000703 Tatum, R. FISH LIMITS...ARE THEY STILL NECESSARY? Tenn. Wildl. 3 (1): 13. July-Aug. 1979. SFA 25(1)
[Tenn. Wildl. Resour. Agency, Nashville 37204]

FISH CONTROL AND REMOVAL

80-000704 Laarman, P. W. EVALUATION OF A CHEMICAL RECLAMATION AND RESTOCKING PROGRAM ON THE HURON RIVER IN THE DETROIT METROPOLITAN AREA. Mich. Dep. Nat. Resour. Fish. Res. Rep. No. 1866. 34p. 21 June 1979. SFA 25(1)
About 40 miles of the Huron River, including seven impoundments (1215 ha) in Washtenaw and Wayne counties, were treated with 2 ppm of rotenone. Chemical treatment was done in three segments between October 1972 and October 1973. An estimated 1,016 metric tons of fish (95 percent carp) were eradicated and more than 17 million fish of desirable species were stocked to provide a sport fishery. The major evaluation was done by post-treatment creel censuses on the three segments of the river. Post-treatment censuses were conducted during the open-water seasons from 1974-1976 on the upper section, 1974-1977 on Ford Lake, and 1975-1978 on Belleville Lake. Pre-treatment data were taken from a one-year census in 1972 on the upper section and from a mail survey in 1973 on Belleville Lake. On the upper segment of the river, no significant change in fishing pressure was evident after treatment. On Ford Lake and Belleville Lake during the post-treatment

80-000704 CONTINUED
period, the mean annual increases in angler trips were 18,259 and 83, 388, respectively. Based on an expanded 5-year pre- and post-treatment period and a recreational value of $8.99 per angler trip, the benefit: cost ratio was 4.1:1 (plus or minus 5.3:1) on the upper segment, 5.7:1 (plus or minus 1.0:1) on Ford Lake, and 25.3:1 (plus or minus 4.5:1) on Belleville Lake. The benefit:cost ratio for the entire reclamation project was 13.9:1 (plus or minus 2.2:1).

MARKING AND TAGGING

80-000705 Gray, R. H.; Haynes, J. M. SPAWNING MIGRATION OF ADULT CHINOOK SALMON (/ONCORHYNCHUS TSHAWYTSCHA/) CARRYING EXTERNAL AND INTERNAL RADIO TRANSMITTERS. J. Fish. Res. Board Can. 36 (9): 1060-1064. Sept. 1979. In English with French summ. SFA 25(1)
[Freshwater Sci., Ecosyst. Dep., Battelle, Pac. Northwest Lab., Richland, WA 99352]

80-000706 Gunn, J. M.; Ridgeway, J. M.; Rubec, P. J.; Qadri, S. U. GROWTH CURTAILMENT OF BROWN BULLHEADS TAGGED DURING THE SPRING SPAWNING PERIOD. Prog. Fish-Cult. 47 (4): 216-217. Oct. 1979. SFA 25(1)
[Minist. Nat. Resour., Box 3500, Sudbury, ON P3A 4S2, Canada]

80-000707 Harshbarger, T. J. SCRAPING IMPROVES SILVER NITRATE BRANDS ON TROUT. Prog. Fish-Cult. 47 (4): 209. Oct. 1979. SFA 25(1)
[U.S. For. Serv., Southeast For. Exp. Stn., Asheville, NC 28806]

80-000708 Jones, R. MATERIALS AND METHODS USED IN MARKING EXPERIMENTS IN FISHERY RESEARCH. FAO Fish. Tech. Pap. No. 190. 134p. 1979. Available from FAO of the UN, Rome, Italy SFA 25(1)
[Mar. Lab., Aberdeen, Scotland]

80-000709 MacCrimmon, H. R.; Robbins, W. H. SUITABILITY OF JAW AND ATKINS STREAMER TAGS FOR MARKING SMALLMOUTH BASS, /MICROPTERUS DOLOMIEUI/. Trans. Am. Fish. Soc. 108 (5): 499-501. Sept. 1979. SFA 25(1)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-000710 McNeil, F. I.; Crossman, E. J. FIN CLIPS IN THE EVALUATION OF STOCKING PROGRAMS FOR MUSKELLUNGE, /ESOX MASQUINONGY/. Trans. Am. Fish. Soc. 108 (4): 335-343. July 1979. SFA 25(1)
[E. J. Crossman: Dep. Ichthyol. Herpetol., Royal Ontario Mus., Toronto, ON M5S 2C6, Canada]

STOCKING AND INTRODUCTIONS

80-000711 Bjornn, T. C.; Hiebert, P.; Ringe, R. R. SEAWARD MIGRATION OF DWORSHAK HATCHERY STEELHEAD TROUT IN 1977 AS RELATED TO REARING HISTORY. Univ. Idaho For. Wildl. Range Exp. Stn. Tech. Rep. 10. vii + 58p. June 1979. SFA 25(1)
[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843]

80-000712 Harshbarger, T. J.; Porter, P. E. SURVIVAL OF BROWN TROUT EGGS: TWO PLANTING TECHNIQUES COMPARED. Prog. Fish-Cult. 47 (4): 206-209. Oct. 1979. SFA 25(1)
[U.S. For. Serv., Southeast For. Exp. Stn., Asheville, NC 28806]

80-000713 Johnston, T. B. CATCHABLE TROUT--A CONSENSUS NEEDED. Fisheries (Bull. Am. Fish. Soc.) 4 (5): 14-15. Sept.-Oct. 1979. SFA 25(1)

80-000714 Reimers, P. E. SUCCESS IN A HATCHERY PROGRAM WITH FALL CHINOOK SALMON BY SIMULATING THE NATURAL LIFE HISTORY OF THE STOCK. Prog. Fish-Cult. 47 (4): 192-195. Oct. 1979. SFA 25(1)
[Coastal Salmon Ecol. Prog., Oreg. Dep. Fish Wildl., Charleston 97420]

80-000715 Sholes, W. H.; Hallock, R. J. AN EVALUATION OF REARING FALL-RUN CHINOOK SALMON, /ONCORHYNCHUS TSHAWYTSCHA/, TO YEARLINGS AT FEATHER RIVER HATCHERY, WITH A COMPARISON OF RETURNS FROM HATCHERY AND DOWNSTREAM RELEASES. Calif. Fish Game 65 (4): 239-255. Oct. 1979. SFA 25(1)
[Box 164, Elmira, CA 95625] Fall-run chinook salmon, /Oncorhynchus tshawytscha/, were reared to yearlings (wt = 58 g) at Feather River Salmon and Steelhead Hatchery, and released in equal numbers at the hatchery and 225 km downstream in the lower Sacramento River near Rio Vista. Combined returns to the fisheries and spawning stocks were 7.5 percent: 6.1 percent to the fisheries and 1.4 percent to the spawning stocks. Yearlings released at the hatchery contributed more to the fisheries and spawning stocks (8.3 percent), with considerably less straying from the natal stream, than those released near Rio Vista (6.6 percent). When compared with returns from fingerling salmon (wt = 5 g), yearlings released at the hatchery contributed 12 times more to the fisheries. Based on minimum contributions to the fisheries and spawning stocks of all marked yearlings of the three brood years released, the benefit/cost ratio was 18.0:1.

80-000716 Wahle, R. J.; Smith, R. Z. A HISTORICAL AND DESCRIPTIVE ACCOUNT OF PACIFIC COAST ANADROMOUS SALMONID REARING FACILITIES AND A SUMMARY OF THEIR RELEASES BY REGION, 1960-76. NOAA Tech. Rep. NMFS SSRF- 736. iv + 40p. Sept. 1979. SFA 25(1)
[NMFS, 811 NE Oregon St., P.O. Box 4332, Portland, OR 97208] A brief history of the artificial culture of salmonid fishes in North America is presented. The report contains a Pacific coast section followed by sections for each of six major regions on the coast: Alaska, British Columbia, Washington coastal and Puget Sound, Columbia Basin, Oregon coastal, and California. The Columbia Basin is further divided into three subregions. The Pacific coast section provides information on current production of anadromous salmon (/Oncorhynchus/ spp.) and trout (/Salmo/ spp.). Each regional or subregional section contains a short history and background, a map with current rearing facilities located, a general hatchery information table, and migrant

80-0007 CONTINUED
release tables summarized by species. In the final portion of the report, changes in numbers of facilities, species reared, rearing techniques, and size at time of release are discussed.

80-000717 Wharton, J. C. F. IMPACT OF EXOTIC ANIMALS, ESPECIALLY EUROPEAN CARP /CYPRINUS CARPIO/, ON NATIVE FAUNA. Victoria Fish. Wildl. Pap. No. 20. 13p. Mar. 1979. SFA 25(1)
[Fish. Wildl. Div., 250 Victoria Parade, East Melbourne, Victoria, Australia 3002]

FISHING GEAR AND TECHNIQUES

80-000718 Bath, D. W.; Hernandez, J. A.; Rippolon, T.; McCarey, G. TECHNIQUE FOR SIMULTANEOUS SAMPLING OF PLANKTONIC FISH EGGS AND LARVAE AT THREE DEPTHS. Prog. Fish-Cult. 41 (3): 158-160. July 1979. SFA 25(1)
[N.Y. Univ. Med. Cent., Inst. Environ. Med., 500 First Ave., New York, NY 10016]

80-000719 Collins, J. J. RELATIVE EFFICIENCY OF MULTIFILAMENT AND MONOFILAMENT NYLON GILL NET TOWARDS LAKE WHITEFISH (/COREGONUS CLUPEAFORMIS/) IN LAKE HURON. J. Fish. Res. Board Can. 36 (10): 1180-1185. Oct. 1979. In English with French summ. SFA 25(1)
[Ontario Minist. Nat. Resour., South Bay Fish. Res. Stn., Tehkummah, ON P0P 2C0, Canada]

80-000720 Corcoran, M. F. ELECTROFISHING FOR CATFISH: USE OF LOW-FREQUENCY PULSED DIRECT CURRENT. Prog. Fish-Cult. 47 (4): 200-201. Oct. 1979. SFA 25(1)
[Dep. Zool., Duke Univ., Durham, NC 27706]

80-000721 Gjernes, T. A PORTABLE MIDWATER TRAWLING SYSTEM FOR USE IN REMOTE LAKES. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. no. 888. iii + 13p. June 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] A midwater trawling system capable of fishing over a wide depth range in lakes and also small enough to be transported by float-equipped aircraft was developed and tested. Two inflatable boats were used; the trawl was put out from one boat and towed from another equipped with a small winch. The trawl caught fish from the surface to depths greater than 50 m. Young sockeye salmon (/Oncorhynchus nerka/, fork length 30-100 mm) caught with this trawl (2 x 2 m at the mouth) were not significantly different in size than fish caught in a larger (3 x 6 m) trawl fished at greater speed. However, samples collected with the smaller trawl were more variable in size and number which suggests the 2 x 2-m net probably is close to the minimum size suitable for collecting these fish.

80-000722 Main, J.; Sangster, G. I. A STUDY OF BOTTOM TRAWLING GEAR ON BOTH SAND AND HARD GROUND. Scott. Fish. Res. Rep. No. 14. 15p. 1979. SFA 25(1)
[Mar. Lab., Aberdeen, Scotland]

80-000723 Tarplee, W. H., Jr.; Bryson, W. T.; Sherfinski, R. G. PORTABLE PUSH-NET APPARATUS FOR SAMPLING ICHTHYOPLANKTON. Prog. Fish-Cult. 47 (4): 213-215. Oct. 1979. SFA 25(1)
[Carolina Power and Light Co., Environ. Technol. Sect., Harris Energy Environ. Cent., New Hill, NC 27562]

FERTILIZATION OF WATER AND SOIL

80-000724 Noriega-Curtis, P. PRIMARY PRODUCTIVITY AND RELATED FISH YIELD IN INTENSELY MANURED FISHPONDS. Aquaculture 17 (4): 335-344. Aug. 1979. SFA 25(1)
[Apdo. Postal 94-28, Mexico 10, Mexico] Studies of various parameters associated with productivity were conducted in experimental manured ponds with the object of estimating the effects that organic manure produce on fish yield. Photosynthesis-depth profiles showed autoshading by the plankton resulting in compensation depths of approximately 70 cm. Net photosynthetic rates were found to be only slightly higher than those obtained under chemical fertilization. Their variation seemed to be somewhat independent of the total standing crop of plankton but was more directly related to the composition of the plankton. Several fish yield prediction models based on primary productivity were applied to the experimental data. In every case the results show that the actual yields considerably exceeded the predicted yields. This work gives support to the notion that primary productivity is not sufficient to account for the high fish yields attained in a manured system. Thus it is concluded that manuring of fish ponds may not only be a practice of fertilization but also a means of promoting growth of fish through some other alternative pathway.

80-000725 Stockner, J. G. LAKE FERTILIZATION AS A MEANS OF ENHANCING SOCKEYE SALMON POPULATIONS: THE STATE OF THE ART IN THE PACIFIC NORTHWEST. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 740. iii + 14p. Mar. 1979. In English with French summ. SFA 25(1)
[Fish. Mar. Serv., 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] A review of the state of the art of lake enrichment as a means of increasing sockeye salmon and resident lake kokanee populations is presented. A review of case histories where lake fertilization or cultural eutrophication has been evaluated provides the framework for identifying research priorities which are subsequently listed and discussed in relation to their applicability to a core enhancement program and/or their scientific and regional suitability. Logistic, technical, and social problems encountered in past investigations are identified and listed for consideration in future programs.

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

80-000726 Kelso, J. R. M.; Milburn, G. S. ENTRAINMENT AND IMPINGEMENT OF FISH BY POWER PLANTS IN THE GREAT LAKES WHICH USE THE ONCE-THROUGH COOLING PROCESS. J. Great Lakes Res. 5 (2): 182-194. 1979. SFA 25(1)
[Dep. Fish. Oceans, Great Lakes Biolimnol. Lab., 875 Queen St. East, Sault Ste. Marie, ON P6A 2B3, Canada]

80-000727 McCabe, G. T., Jr.; Long, C. W.; Park, D. L. BARGE TRANSPORTATION OF JUVENILE SALMONIDS ON THE COLUMBIA AND SNAKE RIVERS, 1977. Mar. Fish. Rev. 41 (7): 28-34. July 1979. SFA 25(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] During the spring of 1977 the National Marine Fisheries Service, in cooperation with the U.S. Army corps of Engineers, used two cargo tank barges to transport juvenile salmonids down the Snake and Columbia Rivers (through as many as eight dams) to safe release sites in the lower Columbia River. Barge design and performance are described. The transported Pacific salmon, /Oncorhynchus/ sp., and steelhead trout, /Salmo gairdneri/, were continually supplied with fresh river water pumped through the barge. Fish were released in the main channel approximately 9 km (5.6 miles) below Bonneville Dam, the lowermost dam on the Columbia River. A total of 3,517,242 juvenile Pacific salmon and steelhead trout were hauled on the barges.

80-000728 Powell, D. H.; Spencer, S. L. PARALLEL-BAR BARRIER PREVENTS FISH LOSS OVER SPILLWAYS. Prog. Fish-Cult. 47 (4): 174-175. Oct. 1979. SFA 25(1)
[Dep. Conserv. Nat. Resour., Game Fish Div., Montgomery, AL 36130]

MATHEMATICS, STATISTICAL METHODS AND MODELING

80-000729 Butler, S. A.; McDonald, L. L. A SIMULATION STUDY OF A CATCH-EFFORT MODEL FOR ESTIMATING MORTALITY RATES. Trans. Am. Fish. Soc. 108 (4): 353-357. July 1979. SFA 25(1)
[Dep. Zool., Univ. Wyo., Laramie 82071]

80-000730 Clark, C. W.; Mangel, M. AGGREGATION AND FISHERY DYNAMICS: A THEORETICAL STUDY OF SCHOOLING AND THE PURSE SEINE TUNA FISHERIES. NOAA Fish. Bull. 77 (2): 317-337. Apr. 1979. SFA 25(1)
[Dep. Math., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada] This paper describes mathematical models of exploited fish stocks under the assumption that a certain portion of the stock becomes available through a dynamic aggregation process. The surface tuna fishery is used throughout as an example. The effects of aggregation on yield-effort relationships, indices of abundance, and fishery dynamics are discussed. The predictions of the theory are notably different from those obtained from general-production fishery models, particularly in cases where the available substock has a finite saturation level. Possible effects include fishery "catastrophes" and lack of significant correlation between catch-per-unit-effort statistics and stock abundance. Various management implications of the models are also discussed.

80-000731 Coombs, R. F. ESTIMATING POPULATION PARAMETERS IN AN 'OPEN' FISH POPULATION. N.Z. J. Mar. Freshwater Res. 13 (1): 121-129. 1979. SFA 25(1)

[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19062, Wellington, New Zealand] A model for an 'open' fish population is described. Basically an expansion of the classical catch equation, it includes a 'population change' coefficient to allow for changes in population size induced by causes other than fishing. The model relates this coefficient to catch, fishing effort, initial population size, and catchability coefficient. With observed catch and fishing effort data incorporated, the remaining parameters are estimated by minimising sums of squares. This estimation process is applied to data from both real and simulated fisheries, and is shown to be effective if the basic assumptions of the model are met. If this is not so considerable errors occur, and these are investigated with respect to the examples.

80-000732 DeAngelis, D. L.; Cox, D. K.; Coutant, C. C. CANNIBALISM AND SIZE DISPERSAL IN YOUNG-OF-THE-YEAR LARGEMOUTH BASS: EXPERIMENT AND MODEL. Ecol. Model. 8: 133-148. Jan. 1980. SFA 25(1)

[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830] A mathematical model for the dynamics of a population of young-of-the-year largemouth bass was formulated on the basis of laboratory experiments. The model was used to make a tentative test of the hypothesis that differing availabilities of alternative foods are decisive in determining the rates of cannibalism and, hence, differences in the observed behavior of the laboratory populations. It was found that slight differences in the degree of dispersal of initial sizes of individuals were probably more important in influencing the population dynamics than alternative food availability or other factors. The model was then compared with data on largemouth bass growth from pond experiments, which showed that, with some modifications of parameter values, the model is also capable of describing the young-of-the-year population dynamics in a pond.

80-000733 Gatto, M.; Rinaldi, S. ESTIMATING ESCAPEMENTS OF ANADROMOUS FISHES VIA UPSTREAM TEST FISHING DATA. Ecol. Model. 8: 173-188. Jan. 1980. SFA 25(1)

[Cent. Teoria Sist., C.N.R., Politec. Milano, Milano, Italy] In many cases escapements of anadromous fishes are not counted directly but upstream test fishing data are quite often available. This paper suggests simple procedures for estimating escapements from test data and asks whether direct counting is always necessary. The application of these techniques to the study of steelhead trout status in the Skeena River (B.C., Canada) is reported on. Estimates of several interesting quantities (annual escapements, annual returns, etc.) are obtained and shown.

80-000734 Gatto, M.; Rinaldi, S. ON THE DETERMINATION OF A COMMERCIAL FISHERY PRODUCTION MODEL. Ecol. Model. 8: 165-172. Jan. 1980. SFA 25(1)

[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC, Canada]

80-000735 Hilborn, R. COMPARISON OF FISHERIES CONTROL SYSTEMS THAT UTILIZE CATCH AND EFFORT DATA. J. Fish. Res. Board Can. 36 (12): 1477-1489. Dec. 1979. In English with French summ. SFA 25(1)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-000736 Mendelssohn, R. DETERMINING THE BEST TRADE-OFF BETWEEN EXPECTED ECONOMIC RETURN AND THE RISK OF UNDESIRABLE EVENTS WHEN MANAGING A RANDOMLY VARYING POPULATION. J. Fish. Res. Board Can. 36 (8): 939-947. Aug. 1979. In English with French summ. SFA 25(1)
[NMFS, Southwest Fish. Cent., Honolulu, HI 96812]

80-000737 Moller, F. MANUAL OF METHODS IN AQUATIC ENVIRONMENT RESEARCH. PART 5--STATISTICAL TESTS. FAO Fish. Tech. Pap. No. 182. 131p. 1979. Available from FAO of the UN, Rome, Italy SFA 25(1)
[Ist. Econ. Polit. Agr., Univ. Milan, Italy]

80-000738 Siegel, R. A.; Mueller, J. J.; Rothschild, B. J. A LINEAR PROGRAMMING APPROACH TO DETERMINING HARVESTING CAPACITY: A MULTIPLE SPECIES FISHERY. NOAA Fish. Bull. 77 (2): 425-433. Apr. 1979. SFA 25(1)
[NMFS, Off. Resour. Conserv. Manage., Washington, DC 20235]

80-000739 Vlinov, V. V. A MODEL OF THE ABUNDANCE OF MONOCYCLIC FISH POPULATION WITH INDEPENDENT YEAR CLASSES. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.) 18 (3): 393-399. 1978. SFA 25(1)
[VNIRO, Moscow, USSR] On the basis of a method submitted by the author in previous works, a mathematical model of a population of a monocyclic type with intermittent and nonintermittent spawning has been constructed. The population is modeled on a system of automatic-control, including units of elimination and potential survival and pulse links.

80-000740 Weinstein, M. P.; Logan, D. T. DIVERSITY AS A MEASURE OF ALEWIFE (/ALOSA PSEUDOHARENGUS/) DOMINANCE IN SOUTHEASTERN LAKE ONTARIO. J. Great Lakes Res. 5 (2): 139-143. 1979. SFA 25(1)
[Dep. Biol., Va. Commonwealth Univ., Richmond, 23284] Nearshore fish assemblages at Nine Mile Point, Lake Ontario, were sampled with gill nets twice a month from April to December in 1974 and 1975. Seasonal fluctuations in diversity (H') were compared with and without the presence of alewife (/Alosa pseudoharengus/), which comprised about 75 percent of the total number of individuals. Because H' was highly correlated with the proportional contribution (p(i) log p(i)) of alewife abundance, fairly large temporal changes in composition of the remainder of the fish community were masked. This effect was explained by certain properties of the H' index; i.e., once a species has a dominance greater than about 70 percent, it influences H', not only through its own contribution, but also by restricting p(i) values for all other species below 0.30, the region where the index is most sensitive to change.

80-000741 Yeh, G.-T.; Yeh, C. F. MATHEMATICAL MODELING OF THE DISTRIBUTION OF FISH EGGS FROM SPAWNING REGIONS OF A RIVER. Ecol. Model. 8: 97-107. Jan. 1980. SFA 25(1)
[Oak Ridge Natl. Lab., Oak Ridge, TN 37830] A deterministic mathematical model, based on the conservation of numbers, is proposed for predicting the distribution of fish eggs after they drift away from the spawning regions. In the model, the effects of egg settling, diffusion capability of the water body, river currents and river boundaries are all included. Close form solution is obtained for the governing partial differential equation. In deriving the solution, egg-flux across river banks, water surface or bottom is suppressed. Application of the model is illustrated by an example. The result should provide the biological community with a quick and easy way of predicting the location of fish eggs in a river.

LAKE MANAGEMENT & RESEARCH

80-000742 Barica, J.; Mathias, J. A. OXYGEN DEPLETION AND WINTERKILL RISK IN SMALL PRAIRIE LAKES UNDER EXTENDED ICE COVER. J. Fish. Res. Board Can. 36 (8): 980-986. Aug. 1979. In English with French summ. SFA 25(1)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

80-000743 Benda, R. S. ANALYSIS OF CATCH DATA FROM 1968 TO 1976 FROM NINE FISH LANDINGS IN THE KENYA WATERS OF LAKE VICTORIA. J. Fish Biol. 15 (4): 385-387. Oct. 1979. SFA 25(1)
[Coop. Fish. Res. Unit, S. Dak. State Univ., Brookings 57007]

80-000744 Henry, F. D., Jr. THE INTRODUCTION OF SOUTHEASTERN BLUEGILL, /LEPOMIS MACROCHIRUS PURPURESCENS/, INTO LAKE PERRIS, CALIFORNIA, WITH NOTES ON THE GROWTH OF THE INITIAL YEAR CLASS. Calif. Fish Game 65 (4): 279-281. Oct. 1979. SFA 25(1)
[Calif. Dep. Fish Game, Oper. Res. Br., 2201 Garden Rd., Monterey 93940]

80-000745 Martin, G. G. IMPACT OF FISHING ON THE INSHORE FISHERY OF LAKE VICTORIA (EAST AFRICA). J. Fish. Res. Board Can. 36 (8): 891-900. Aug. 1979. In English with French summ. SFA 25(1)
[Environ. Policy Inst., East-West Cent., Honolulu, HI 96848]

80-000746 Otto, C. THE EFFECTS ON A PIKE (/ESOX LUCIUS/ L.) POPULATION OF INTENSIVE FISHING IN A SOUTH SWEDISH LAKE. J. Fish Biol. 15 (4): 461-468. Oct. 1979. SFA 25(1)
[Dep. Zool., Univ. Stockholm, Box 6801, S-113 86 Stockholm, Sweden] During seven years of intensive fishing, the average individual size of pike caught declined progressively until the last year of the study. The size structure of the population markedly changed. Three phases could be identified. 1. a high proportion of large fish, 2. a high proportion of small fish, and 3. equal numbers of large and small fish. The growth of the different year classes in their first year of life showed an increase from 180 to 220 mm.

80-000747 Regier, H. A. CHANGES IN SPECIES COMPOSITION OF GREAT LAKES FISH COMMUNITIES CAUSED BY MAN. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 558-566. 1979. SFA 25(1)
[Inst. Environ. Stud., Univ. Toronto, Toronto, ON, Canada]

80-000748 Whillans, T. H. HISTORIC TRANSFORMATIONS OF FISH COMMUNITIES IN THREE GREAT LAKES BAYS. J. Great Lakes Res. 5 (2): 195-215. 1979. SFA 25(1)
[Inst. Environ. Stud., Univ. Toronto, Toronto, ON M5S 1A4, Canada]
Fish community transformation is investigated for the period from early settlement to the present in Toronto and Burlington Bays, Lake Ontario, and Inner Long Point Bay, Lake Erie. Extensive historic documentation and interviews are combined as case histories detailing changes in fish communities due to changes in water levels, temperature, shoreline configuration, circulation, inflow, watershed conditions, bathymetry, bottom materials, siltation, water conditions, aquatic macrophytes, plankton, benthic invertebrates, stocked fish, commercial and sport fishing. The most stressful perturbations were shoreline and benthic modifications in Toronto Bay, deteriorating water conditions in Burlington Bay, and exploitation in Inner long Point Bay. Differences between responses of pelagic migrants and near-shore residents to stress appeared to vary according to preadaptation of the species and the flexibility of its life pathways. The overall transformations of the communities have some similarities between time periods and from community to community.

RIVER AND STREAM MANAGEMENT & RESEARCH

80-000749 Alexander, G. R.; Buc, W. J.; Schnicke, G. T. TRENDS IN ANGLING AND TROUT POPULATIONS IN THE MAIN AU SABLE AND NORTH BRANCH AU SABLE RIVERS FROM 1959 THROUGH 1976. Mich. Dep. Nat. Resour. Fish. Res. Rep. No. 1865. 59p. 11 June 1979. SFA 25(1)
The anglers' fishing effort and catch of trout were lower in the Main Au Sable but higher in the North Branch of the Au Sable over the years 1959 through 1976. Brown trout growth became poorer over time in the Burton's Landing to Wakeley Bridge segment of the Main Au Sable, but decreased little in the other river segments studied. Brook trout growth did not change significantly in any river segment. Survival rates of second and third summer brown trout were better in both streams during the later years of investigation. Brook trout survival rates remained relatively constant. The total trout population (standing crop by weight) generally decreased in the Main Au Sable but increased in the North Branch of the Au Sable. Brown trout populations became progressively higher and brook trout lower during the study period. The causes for the changes noted cannot be determined with certainty because of the many alterations made in the fish habitat, fish stocking policies and fishing regulations.

80-000750 Blackett, R. F. ESTABLISHMENT OF SOCKEYE (/ONCORHYNCHUS NERKA/) AND CHINOOK (/O. TSHAWYTSCHA/) SALMON RUNS AT FRAZER LAKE, KODIAK ISLAND, ALASKA. J. Fish. Res. Board Can. 36 (10): 1265-1277. Oct. 1979. In English with French summ. SFA 25(1)
[Alaska Dep. Fish Game, Kodiak 99615]

80-000751 Mauney, M. ASSESSMENT OF THE IMPACT OF A SHALLOW RESERVOIR ON BENTHIC MACROINVERTEBRATE AND FISH COMMUNITIES OF A SECOND ORDER STREAM IN THE VIRGINIA PIEDMONT. Ph.D. dissertation, Va. Polytech. Inst. State Univ. 161p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5):2034. Nov. 1979. SFA 25(1)

An investigation was conducted over a 12-month period to determine the extent of impact of an 88 ha impoundment on downstream water quality and aquatic consumer communities. The downstream impact of the reservoir was very localized. Most physical, chemical, and biotic parameters examined 1200 m below the dam were equivalent to upstream levels or were intermediate between those of the upstream and tailwaters stations.--From abstr.

80-000752 Moffitt, C. M. RECOLONIZATION OF AMERICAN SHAD, /ALOSA SAPIDISSIMA/ (WILSON) ABOVE RAINBOW DAM FISHLADDER, FARMINGTON RIVER, CONNECTICUT. Ph.D. dissertation, Univ. Mass. 144p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(3):1045. Sept. 1979. SFA 25(1)

Natural recolonization of American shad was studied for two years, 1976-1977, following construction of Rainbow Dam fishladder, Farmington River, Connecticut. In both years of operation approximately 50 to 60 percent of the shad seen moving upstream in the fishladder at the counting window actually entered the reservoir. Shad that did not enter the reservoir dropped out of the fishladder chiefly at sunset, or died and were recovered from the fishladder. Prespawning upstream movements in the ladder were concentrated during afternoon hours. Spawning was documented at night in the upper reservoir areas in both years. In 1977, successful spawning was also recorded 16 km upstream from the dam, above a white water area. Downstream migrations of postspawning adults occurred from mid June to mid July and were positively correlated with increased flow rates into the fishladder. Only with increased water flow did adult shad re-enter the fishladder, and only 5 percent of the successful upstream migrants were observed moving downstream alive in 1977. Mortality in prespawning and postspawning adults was significanly higher for females and was consistent with observations of fewer repeat spawning scars on female shad scales in this and other shad studies.--From abstr.

80-000753 Welcomme, R. L. , (compiler) FISHERY MANAGEMENT IN LARGE RIVERS. FAO Fish. Tech. Pap. No. 196. v + 60p. Apr. 1979. SFA 25(1)

[FAO of the UN, Rome, Italy]

LARGE IMPOUNDMENT MANAGEMENT & RESEARCH

80-000754 Bruce, W. J.; Parsons, R. F. BIOLOGY OF THE FISHES OF OSSOKMANUAN RESERVOIR, LABRADOR, 1976. Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep. No. 836. iv + 33p. May 1979. In English with French summ. SFA 25(1)

[Fish. Mar. Serv., P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

Experimental gillnet sets on the Ossokmanuan Reservoir, Labrador revealed /Coregonus clupeaformis/ and /Catostomus catostomus/ were the dominant fish species. Other species present included /Salvelinus namaycush/, /Esox lucius/, /Lota lota/, landlocked /Salmo salar/, /Prosopium cylindraceum/ and /Catostomus commersoni/. /Coregonus clupeaformis/ and /Catostomus catostomus/ displayed an increase in mean length with increasing mesh size but lake trout and northern pike did not. Catch per unit of effort (kg/100 m of net/24 h) values for lake whitefish varied from 0 to 4.4, while trout values ranged from 0.3 to 16.7. Lake whitefish growth rate was slow and there was

80-000754 CONTINUED
considerable overlap of ages for different length intervals; annual mortality rate was 0.4; age at first maturity ranged from 3 to 11 years; fecundity ranged from 967 (16.3 cm) to 20,963 (46.0 cm). Lake trout growth was slow; age at first maturity was 10 years. Egg counts from 24 fish ranged from 1662 (50.9 cm) to 11,906 (78.8 cm).

ESTUARY MANAGEMENT & RESEARCH

80-000755 MacFarland, J. W.; Weinstein, R. S. THE NATIONAL ESTUARINE SANCTUARY PROGRAM. Coast. Zone Manage. J. 6 (1): 89-97. 1979. SFA 25(1)
[Off. Coast. Zone Manage., NOAA, U.S. Dep. Commer., Washington, DC] In the 1972 Coastal Zone Management Act, Congress established the Estuarine Sanctuary Program in response to two government studies showing that estuaries are economically and ecologically valuable to man and that they are in danger of being physically altered and polluted. The program makes available fifty-percent matching grants to coastal states to help them set aside estuarine areas for the purposes of research and education. The sanctuaries will serve as natural outdoor laboratories for scientists and the public, and will also help to preserve natural habitats for estuarine dependent species. The information gained within these areas will aid in future management decisions concerning the coastal zone. the sanctuaries are established and operated under the Estuarine Sanctuary Guidelines, which provide for three distinct types of grants: preacquisition, acquisition, and operations. At the present time there are five sanctuaries in operation, with others in the planning stage. The five established sanctuaries are in the South Slough, Oregon; Sapelo Island, Georgia; Waimanu, Hawaii; Old Woman Creek, Ohio; and Rookery Bay, Florida.

80-000756 Stevens, D. E.; Chadwick, H. K. SACRAMENTO-SAN JOAQUIN ESTUARY--BIOLOGY AND HYDROLOGY. Fisheries (Bull. Am. Fish. Soc.) 4 (4): 2-6. July-Aug. 1979. SFA 25(1)
[4001 N. Wilson Way, Stockton, CA 95205]

80-000757 Weinstein, M. P. SHALLOW MARSH HABITATS AS PRIMARY NURSERIES FOR FISHES AND SHELLFISH, CAPE FEAR RIVER, NORTH CAROLINA. NOAA Fish. Bull. 77 (2): 339-357. Apr. 1979. SFA 25(1)
[Dep. Biol., Va. Commonwealth Univ., Richmond 23284] Seine and rotenone collections taken during 1977 from the upper reaches of tidal creeks and along the marsh fringe in the vicinity of the Cape Fear River, N.C., indicated that these areas serve as primary nursery habitats for postlarval and juvenile fishes and shellfish. Average densities (number/400m^2) for several ocean-spawned species at the peak of postlarval or early juvenile recruitment were high: spot, /Leiostomus xanthurus/, 3,099; Atlantic menhaden, /Brevoortia tyrannus, 839; striped mullet, /Mugil cephalus/, 711; white mullet, /Mugil curema/, 525; and brown shrimp, /Penaeus aztecus/, 329. Standing crops for the majority of species studied further indicated that lower productivity per unit area occurred in high salinity marshes closest to the ocean. In addition, distribution patterns for several species were significantly correlated with salinity and substrate characteristics or combinations of them and seasonal effects also were evident so that related and potentially competing species were separated temporally. Community analyses demonstrated that each marsh complex was unique; however, overall similarity for the most abundant species was high. The differences were related to salinity gradients and to the presence of an "edge effect" where marshes

80-000757 CONTINUED
closest to the river mouth were species rich due to seasonal invasion by low densities of reef, nearshore, and shelf marine species. Similarly, freshwater fishes invaded brackish marshes during periods of high river flow.

MARINE MANAGEMENT & RESEARCH

80-000758 Elder, R. D. EQUILIBRIUM YIELD FOR THE HAURAKI GULF SNAPPER FISHERY ESTIMATED FROM CATCH AND EFFORT FIGURES, 1960-74. N.Z. J. Mar. Freshwater Res. 13 (1): 31-38. 1979. SFA 25(1)
[Fish. Res. Div., Minist. Agric. Fish. P.O. Box 19062, Wellington, New Zealand] To examine the significance of trends in catch, and to calculate an equilibrium yield for the Hauraki Gulf snapper fishery, catch and effort statistics for Danish seine, trawl, line, and non-powered net fishing methods are analysed for the years 1960-74. The catch per day at sea of a trawl is used as standard, and a catch-effort model is formulated. The model shows that a maximum equilibrium yield of 4153 t per annum from 7402 standard days (=trawl days) fishing at a catch-rate of 561 kg per standard day can be expected from the fishery. The relative fishing power of each method is evaluated against the trawl. The analysis suggests that the increased landings of snapper from the Gulf during the last 6 years have over-exploited the fishery. It is predicted that the down-turn in landings which commenced in 1972-73 will continue unless management action is taken to reduce the level of effort or control landings.

80-000759 FAO of the UN GENERAL FISHERIES COUNCIL FOR THE MEDITERRANEAN. REPORT OF THE FOURTEENTH SESSION NANTES, FRANCE, 16-20 OCTOBER 1978. Gen. Fish. Counc. Mediterr. Rep. 14. 42p. 1978. SFA 25(1)
[Rome, Italy]

80-000760 FAO of the UN REPORT OF THE FIRST SESSION OF THE WESTERN CENTRAL ATLANTIC FISHERY COMMISSION WORKING PARTY ON FISHERY STATISTICS, PANAMA, PANAMA, 16-17 MAY 1978. FAO Fish. Rep. No. 212. v + 29p. 1978. SFA 25(1)
[Rome, Italy]

80-000761 Goulet, J. R., Jr.; Haynes, E. D. , (eds.) OCEAN VARIABILITY IN THE U.S. FISHERY CONSERVATION ZONE, 1976. NOAA Tech. Rep. NMFS Circ. 427. iv + 362p. July 1979. SFA 25(1)
[NMFS, NOAA, Washington, DC 20235]

80-000762 Ingham, M. C. MARINE ENVIRONMENTAL CONDITIONS OFF THE ATLANTIC AND GULF COASTS OF THE UNITED STATES, JANUARY 1977-MARCH 1978. Mar. Fish. Rev. 41 (5/6): 35-47. May-June 1979. SFA 25(1)
[NMFS, Narragansett, RI 02882]

SPORT FISHERY ABSTRACTS

80-000763 Ingraham, W. J., Jr. THE ANOMALOUS SURFACE SALINITY MINIMA AREA ACROSS THE NORTHERN GULF OF ALASKA AND ITS RELATION TO FISHERIES. Mar. Fish. Rev. 41 (5/6): 8-19. May-June 1979. SFA 25(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-000764 International Pacific Halibut Commission INTERNATIONAL PACIFIC HALIBUT COMMISSION ANNUAL REPORT 1978. Int. Pac. Habibut Comm. Annu. Rep. 1978 40p. 1979. SFA 25(1)
[P.O. Box 5009, University Station, Seattle, WA 98105]

80-000765 Laist, D.; Epting, J. HIGHTIDE: THE GROWING NEED FOR FEDERAL-STATE COOPERATION IN MANAGING THE SEA. Coast. Zone Manage. J. 6 (1): 1-7. 1979. SFA 25(1)
[Mar. Mammal Comm., 1625 Eye St., N.W., Washington, DC]

80-000766 Liao, D. S.; Cupka, D. M. ECONOMIC IMPACTS AND FISHING SUCCESS OF OFFSHORE SPORT FISHING OVER ARTIFICIAL REEFS AND NATURAL HABITATS IN SOUTH CAROLINA. S.C. Mar. Resour. Cent. Tech. Rep. No. 38. 27p. May 1979. SFA 25(1)
[Mar. Resour. Res. Inst., S.C. Wildl. Mar. Resour. Dep., Charleston 29412]

80-000767 McLain, D. R.; Favorite, F.; Lynn, R. J. MARINE ENVIRONMENTAL CONDITIONS OFF THE PACIFIC COAST OF THE UNITED STATES, JANUARY 1977-MARCH 1978. Mar. Fish. Rev. 41 (5/6): 48-69. May-June 1979. SFA 25(1)
[NMFS, Monterey, CA 93940]

80-000768 Pedrick, R. A. MARINE ENVIRONMENTAL CONDITIONS OFF THE COASTS OF THE UNITED STATES, JANUARY 1977-MARCH 1978--INTRODUCTION. Mar. Fish. Rev. 41 (5/6): 32-34. May-June 1979. SFA 25(1)
[NMFS, 3300 Whitehaven St. N.W., Washington, DC 20235]

80-000769 Ulrich, G.; Chipley, N.; McCord, J. W.; Cupka, D. DEVELOPMENT OF FISHERY MANAGEMENT PLANS FOR SELECTED ANADROMOUS FISHES IN SOUTH CAROLINA/GEORGIA. S.C. Mar. Resour. Cent. Spec. Sci. Rep. No. 14. iv + 135p. 1979. SFA 25(1)
[S.C. Wildl. Mar. Resour. Dep., P.O. Box 12559, Charleston 29412]

80-000770 Yesaki, M. RAINBOW RUNNER: A LATENT OCEANIC RESOURCE? Mar. Fish. Rev. 41 (8): 1-6. Aug. 1979. SFA 25(1)
[P.O. Box 618, Bangkok, Thailand]

UTILIZATION OF FISHERY PRODUCTS

80-000771 Johnson, J. M., Sr. MANAGEMENT OF UNITED STATES FISH AND WILDLIFE RESOURCES AND SPECIAL RIGHTS OF NATIVE AMERICANS. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 594-600. 1979. SFA 25(1)
[Wash. State Attny. Gen. Off., Olympia]

80-000772 Lien, A. J.; Naish, V. A. DIFFERENCE IN TASTE BETWEEN THE RIGHT AND LEFT SIDES OF TAINTED FISH. J. Fish. Res. Board Can. 36 (11): 1412-1413. Nov. 1979. In English with French summ. SFA 25(1)
[Domtar Inc., Res. Cent., Senneville, PQ H9X 3L7, Canada]

80-000773 Schulz, P. D. FISH REMAINS FROM A HISTORIC CENTRAL CALIFORNIA INDIAN VILLAGE. Calif. Fish Game 65 (4): 273-276. Oct. 1979. SFA 25(1)
[Calif. Dep. Parks Recreation, P.O. Box 2390, Sacramento 95811]

80-000774 Skea, J. C.; Simonin, H. A.; Harris, E. J.; Jackling, S.; Spagnoli, J. J.; Symula, J.; Colquhoun, J. E. REDUCING LEVELS OF MIREX, AROCLOR 1254, AND DDE BY TRIMMING AND COOKING LAKE ONTARIO BROWN TROUT (/SALMO TRUTTA/ LINNAEUS) AND SMALLMOUTH BASS (/MICROPTERUS DOLOMIEUI/ LACEPEDE). J. Great Lakes Res. 5 (2): 153-159. 1979. SFA 25(1)
[N.Y. State Dep. Environ. Conserv., 8314 Fish Hatchery Rd., Rome 13440] Trimming of Lake Ontario smallmouth bass (/Micropterus dolomieui/ Lacepede) and brown trout (/Salmo trutta/ Linnaeus) was found to reduce levels of mirex, Aroclor 1254, and DDE by 43 percent to 64 percent. Trimming included the removal of the skin, dorsal and ventral fat, and the entire lateral line. Of the cooking methods tested (smoking, broiling, baking, and deep frying), only deep frying produced consistently high reductions of all three contaminants.

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[Dep. Appl. Math., Univ. Bergen, 5014 Bergen, Norway]

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[U.S. EPA, Environ. Res. Lab., 6201 Congdon Blvd., Duluth, MN 55804]

80-000777 Meitzel, D. A.; Page, T. L.; Barraclough, S. A. SELF-INFLATING BUOY FOR UNDERWATER USE. Prog. Fish-Cult. 41 (3): 119-120. July 1979. SFA 25(1)
[Battelle Pac. Northwest Lab., Richland, WA 99352]

80-000778 Traynor, J. J.; Ehrenberg, J. E. EVALUATION OF THE DUAL BEAM ACOUSTIC FISH TARGET STRENGTH MEASUREMENT METHOD. J. Fish. Res. Board Can. 36 (9): 1065-1071. Sept. 1979. In English with French summ. SFA 25(1)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

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80-000779 Smith, S. E. CHANGES IN SALTWATER ANGLING METHODS AND GEAR IN CALIFORNIA. Mar. Fish. Rev. 41 (9): 32-44. Sept. 1979. SFA 25(1)
[NMFS, 3150 Paradise Dr., Tiburon, CA 94920]

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80-000780 Baughman, J. WYOMING'S WATER ... GOING FAST. Wyo. Wildl. 43 (12): 6-9. Dec. 1979. SFA 25(1)
[Wyo. Game Fish Dep., Casper]

80-000781 Doucet, G. J.; Bider, J. R. HYDROELECTRIC DEVELOPMENTS IN NORTHERN QUEBEC. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 225-234. 1979. SFA 25(1)
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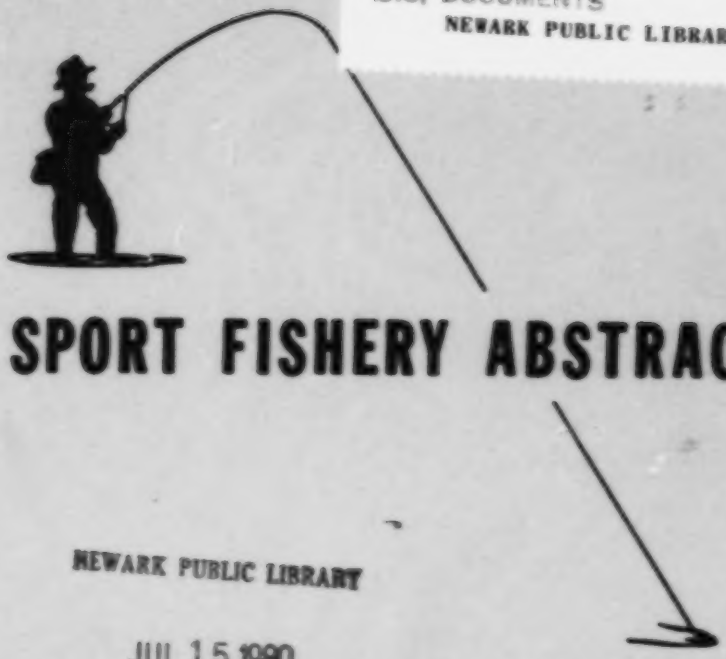

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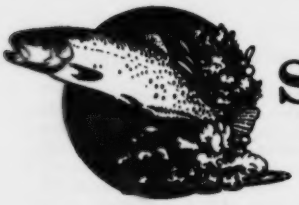

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PLEASE NOTE

This is the first issue of *Sport Fishery Abstracts* for which camera-ready copy has been produced in the Editorial Office. Computer techniques have not been finalized and the copy format is not exactly as we desire. We have decided, however, to publish on schedule rather than wait until every minor problem has been solved, and trust you will accept the few copy irregularities which in no way affect the scientific integrity of the contents.

The Edi.

AQUATIC PLANTS AND THEIR CONTROL

80-000782 Borawa, J. C.; A. W. Mullis; J. H. Kerby and M. T. Huish. COMPARISON OF FISH POPULATION DATA COLLECTED FROM CURRITUCK SOUND, NORTH CAROLINA, BEFORE AND AFTER INFESTATION BY EURASIAN WATERMILFOIL. *J. Elisha Mitchell Sci. Soc.* 94(2):111. 1978. Abstract only. SFA 25(2)

Fish samples obtained by applying rotenone in three areas of Currituck Sound from 1959 to 1965 inclusive, before the Sound became infested with Eurasian watermilfoil (*Myriophyllum spicatum*), were compared with samples from the same areas taken in 1977. Mean total numbers of fish per hectare of sampled area in 1959-65 were significantly lower ($p < 0.05$) than those found in 1977. Estimated total weight of fish per hectare in 1977 was not significantly different from the mean value for estimates based on pre-watermilfoil samples. Largemouth bass (*Micropterus salmoides*) were separated into young-of-the-year and older fish on the basis of length frequency distributions. Numbers of young-of-the-year largemouth bass were not significantly different ($p > 0.05$) before and after watermilfoil invasion. Numbers of older bass per hectare were significantly lower in the 1977 samples. However, differences between the areas sampled may account for this decrease rather than responses of the fish to the watermilfoil.

GENERAL FISH CULTURE

80-000783 Anonymous. PROPAGATION AND DISTRIBUTION OF FISH FROM NATIONAL FISH HATCHERIES FOR FISCAL YEAR 1976. *U.S. Fish Wildl. Serv. Fish Dist. Rep.* 11. 65p. 1979. SFA 25(2)

80-000784 Brown, E. E. THE FOOD, BAIT, TROPICAL AND GOLDFISH INDUSTRIES IN THE U.S.A. *Riv. It. Piscic. Ittiop.* 14(4):117-122. Oct.-Nov.-Dec. 1979. In English and Italian. SFA 25(2)

[Dep. Agric. Econ., Univ. Ga., Athens 30602]

80-000785 Bruley, G. K. and J. L. Horton. CALIFORNIA TROUT, SALMON, AND WARMWATER FISH PRODUCTION AND COSTS, 1978-79. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-1. 48p. Jan. 1980. SFA 25(2)

[Calif. Dep. Fish Game, Inland Fish. Br., Sacramento]

80-000786 Garling, D. L., Jr.; L. A. Helfrich and G. D. Hutton. EDUCATIONAL FACILITIES AND PROGRAMS AT STATE AND FEDERAL FISH HATCHERIES IN THE SOUTHEASTERN UNITED STATES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:774-779. 1978[1979]. SFA 25(2)

[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] In 1977, a 5 page questionnaire was developed and sent to hatchery managers in 11 southeastern states to characterize the status of current hatchery education programs. The survey indicated that approximately 1.4 million people visited the 55 hatcheries providing a unique opporunity to communicate directly with a large segment of the general public. A majority of the managers (98%) recognized the importance of public education and most (71%) felt that their current programs were in need of improvement. The programs relied heavily on self-guided tours, guided tours, an array of audiovisual aids, and publications. Although most managers (72%) felt they could justify increased budgetary allotments for educational program improvement, they did not expect increased funding. Integrating tours, audiovisual materials and publications into an effective program presenting an overview of the total fisheries management program will ultimately result in the greatest benefit to the

GENERAL FISH CULTURE

80-000786 CONTINUED agency and resource. In order to develop improved effective fisheries educational programs at government fish hatcheries, educational programs must be given a higher priority in terms of funding and manpower.

80-000787 Gorbunov, K. V.; A. F. Sokol'skii and N. I. Tamrazova. CORRELATIONS BETWEEN PHYTOPLANKTON AND BACTERIOPLANKTON PRODUCTION AND FISH PRODUCTIVITY IN FISH HATCHERY PONDS OF THE VOLGA DELTA. *Sov. J. Ecol. (Engl. Transl. Ekologiya)* 10(3):223-229. Jan. 1980. SFA 25(2)
Comparative data are presented for biomass, production, and P/B coefficients for microorganisms; also, rations are computed for bacterioplankton and fish in ponds of various categories. It has been established that in spawning-rearing ponds, 2/3 of overall metabolism of the heterotrophic population is made possible by energy contained in allochthonous organic matter. In ponds used for rearing sturgeons and for fattening and rearing carp, the role of allochthonous organic matter was insignificant. The productivity of these ponds is determined by the level of phytoplankton development and the magnitude of primary production. The role of fishes is also considered in the flow of energy in the ecosystems of pools and ponds, as well as other questions.

80-000788 Jhingran, V. G. RECENT ADVANCES IN INLAND AQUACULTURE IN INDIA. *J. Bombay Nat. Hist. Soc.* 75(3):589-599. Dec. 1978. SFA 25(2)
[Cent. Inland Fish. Res. Inst., Barrackpore, India]

80-000789 Leith, D. A., (Chairman). PROCEEDINGS OF THE TWENTY-NINTH ANNUAL NORTHWEST FISH CULTURE CONFERENCE. *Proc. Annu. Northwest Fish Cult. Conf.* 29:v + 114p. 1979. SFA 25(2)
A collection of papers.--RS

80-000790 Orth, D. J. APPLICATIONS OF OPERATIONS RESEARCH AND SYSTEMS SCIENCE IN AQUACULTURE. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):7-9. Jan.-Feb. 1980. SFA 25(2)
[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater]

80-000791 Sarig, S. FISHERIES AND FISH CULTURE IN ISRAEL IN 1978. *Bamidgeh* 31(4):83-95. Dec. 1979. SFA 25(2)
[Lab. Res. Fish Dis., Nir-David, Israel]

80-000792 Scanlon, P. F.; L. A. Helfrich and R. E. Stultz. EXTENT AND SEVERITY OF AVIAN PREDATION AT FEDERAL FISH HATCHERIES IN THE UNITED STATES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:470-473. 1978[1979]. SFA 25(2)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] A survey of Federal fish hatcheries in the United States was conducted to determine the extent and severity of avian predation on fish stocks as well as to determine which avian species were the most serious predators. A list of 58 birds species in 14 families was provided. Managers of hatcheries were asked to indicate which species or members of what family caused problems by predation in their hatcheries. They were asked to provide their estimate of the severity of the problem; i.e. severe, significant, trivial, or none. They were also asked which fish species were preyed upon and also to identify any bird predators not on the list provided. The survey elicited a 66% response from 121 managers. Of the 58 species on the survey form, 28 species in 9 families were

GENERAL FISH CULTURE

80-000792 CONTINUED mentioned by managers as predators visiting fish hatcheries. Additionally, 8 species from 6 other families or subfamilies were added by managers as being pests at hatcheries. Eighteen species in 8 families were mentioned as causing "severe" damage to fish stocks.

TROUT AND SALMON CULTURE

80-000793 Bams, R. A. EVALUATION OF GRAVEL INCUBATORS ON THE THIRD CYCLE OF TSOLUM RIVER PINK SALMON, 1972-74. *Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep.* No. 871. iv + 31p. Mar. 1979. In English with French summ. SFA 25(2)

[Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] A new incubation method was designed for Pacific salmon that migrate to sea as fry, involving deep-gravel incubators. The method required evaluation to establish efficiency of incubation and survival potential of the fry. This report covers the third consecutive test carried out from 1972 to 1974 on the even-year pink salmon population of the Tsolum River, B.C., Canada. About one fifth of the available eggs were taken into the hatchery, the remainder was deposited naturally in the stream. Comparison with the natural population at the fry stage showed that the hatchery treatment was conducive to superior survival (93 versus 21 percent) and equal yolk-conversion efficiency. It did induce the fry to emerge at an average stage of development about 11 days earlier than that of the creek fry, at the prevailing water temperatures. Evaluation at the adult stage was made possible by the release of differentially fin-clipped fry populations of the two incubation treatments. No difference in survival was observed at two sampling locations, the commercial fishery and the main river below the hatchery weir. However, among the marked fish entering the weir the proportion of hatchery fish was significantly less than expected on the basis of numbers of marked fry released. It is concluded that, even though the hatchery treatment resulted in four times as many adults per unit of eggs, fry to adult survival was suppressed by about 6-8 percent in the hatchery fish. This difference in ocean survival may be associated with a delayed mortality of inferior stock, "artificially" kept alive in the hatchery.--From abstr.

80-000794 Busack, C. A. and G. A. E. Gall. ANCESTRY OF ARTIFICIALLY PROPAGATED CALIFORNIA RAINBOW TROUT STRAINS. *Calif. Fish Game* 66(1):17-24. Jan. 1980. SFA 25(2)

[Dep. Anim. Sci., Univ. Calif., Davis 95616] A historical treatment of the ancestry of the nine strains of rainbow trout artificially propagated by the California Department of Fish and Game is presented: Pit River, Eagle Lake, Junction Kamloops, Davis, Mt. Shasta, Virginia, Hot Creek, Mt. Whitney, and Coleman. The first three strains listed are descendants of collections from single populations; the other six are the result of mixing or deliberately crossing strains.

80-000795 Fagerlund, U. H. M. and H. M. Dye. DEPLETION OF RADIOACTIVITY FROM YEARLING COHO SALMON (*ONCORHYNCHUS KISUTCH*) AFTER EXTENDED INGESTION OF ANABOLICALLY EFFECTIVE DOSES OF 17α-METHYLTESTOSTERONE-1,2-^{3}H. *Aquaculture* 18(4):303-315. Dec. 1979. SFA 25(2)

[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Radioactivity in blood and 16 tissues of yearling coho salmon (*Oncorhynchus kisutch*) was followed during 3 days of feeding a diet supplemented with 1 mg/kg 17α-methyltestosterone-1,2-^{3}H (MT) and during 10 days following the withdrawal of the hormone from the diet. Maximum uptake in

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80-000795 CONTINUED blood and non-excretory tissues was apparently reached within 2 h of the first isotope intake. High concentrations of radioactivity in the intact gall bladder 2, 8 and 16 h after a previous isotope intake indicated a hepatobiliary route of elimination. The combined concentrations of MT and its metabolites in blood and tissues, calculated as MT equivalents from residual radioactivity, were generally higher than those previously reported for testosterone, which may explain the greater anabolic effect of MT. After 10 days of feeding the hormone-free diet, the concentration of radioactive substances was reduced to less than 1 ng/g (=ppb) in all tissues. The highest concentration at that time 0.98 ng/g, appeared in the liver.

80-000796 Jarrams, P. EGG, FRY AND SMOLT PRODUCTION FROM SALMON, *SALMO SALAR* L. AND SEA TROUT *SALMO TRUTTA* L. REARED ENTIRELY IN FRESH WATER. *J. Fish Biol.* 15(5):607-611. Nov. 1979. SFA 25(2)
[Severn Trent Water Auth., Area Fish. Off., Meadow Lane, Nottingham, England]

80-000797 Jensen, J. W. WINTER CULTURE OF RAINBOW TROUT (*SALMO GAIRDNERI*) IN EARTHEN PONDS AT AUBURN, ALABAMA. *Ph.D. dissertation, Auburn Univ.* 69p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3504. Feb. 1980. SFA 25(2)
Rainbow trout were cultured successfully in standing-water earthen ponds at Auburn, Alabama, during winter. In open-water culture, fish fed according to a feeding chart increased in weight as stocking density increased. Maximum standing crop attained was 1,990 kg/hectare. A satiation feeding study gave inconclusive results as to amounts of food fish would consume voluntarily at different water temperatures. Rainbow trout in 0.45 m^3 cages in a watershed pond produced 67.6 kg/m^3 of cage volume. Net production increased as stocking density increased in cages. Fish in earthen ponds fed according to a feeding chart converted food at an average rate of 1 kg fish per 1.2 kg food both years (conversion value = 1.2). Cage-reared trout converted food less efficiently (conversion value = 1.6). Survival for all experiments was about 90%. Use of rainbow trout in a double-crop aquacultural system with channel catfish will lead to greater profits than catfish alone. In a 1-hectare pond, net income from trout would amount to $1,139. Catfish alone would provide $972 in net returns.

80-000798 Light, J. T.; C. A. Sikora and J. T. Windell. HATCHABILITY OF EYED AND GREEN RAINBOW TROUT (*SALMO GAIRDNERI*) EGGS IN FIELD AND LABORATORY PLACED WHITLOCK/VIBERT BOXES. *J. Colo-Wyo. Acad. Sci.* 12(1):15. Apr. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Colo., Boulder] A combined laboratory and field study was conducted to investigate the hatchability of rainbow trout (*Salmo gairdneri*) eggs in Whitlock/Vibert boxes. Part I of the study was conducted in the spring and part II in the fall. Part I included 25,000 green eggs of the Arlee strain of rainbow trout placed in Whitlock/Vibert boxes (both black and white) in Boulder Creek and in a controlled laboratory stream. The artificial stream was kept at constant temperature close to that of the natural stream environment. The boxes were observed periodically to determine when all eggs had hatched and fry had evacuated the boxes. It was assumed the stream-placed eggs had completed development at the same time as those in the laboratory. Once recovered, the remaining undeveloped eggs were counted and percent hatchability calculated for the total number of eggs in each box (554) at each location. Hatchability of green eggs (part I - spring) was greater in Boulder Creek (36.5%) than in the laboratory (12%). Hatchability

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80-000798 CONTINUED of eyed eggs (part II - fall) in Boulder Creek was 85.7% whereas only 40.5% hatched in the laboratory. Therefore, it is recommended that eyed eggs be used by fisheries managers to achieve high hatchability in Whitlock/Vibert boxes.

80-000799 Macquarrie, D. W.; W. E. Vanstone and J. R. Markert. PHOTOPERIOD INDUCED OFF-SEASON SPAWNING OF PINK SALMON (*ONCORHYNCHUS GORBUSCHA*). *Aquaculture* 18(4):289-302. Dec. 1979. SFA 25(2)
[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Four groups of pink salmon, which had been reared under artificial light, became sexually mature and produced viable gametes: 59 days prior to, and 19-32 days, 115 days and 220 days after their expected date of reaching sexual maturity. Altered times of sexual maturation were obtained by accelerating, leaving unchanged, or decelerating the rate of change of photoperiod which each group of fish would normally receive during its first year of life. All groups of fish were exposed to a normal rate of change in photoperiod during their final year of life. Mean fecundity was reduced from 800-2000 ova observed in wild stocks, and ranged from 629 for the 59 day advanced fish, to 862 for the 115 day delayed fish. Egg mortality during the period from fertilization to eyeing was much greater in the three groups of fish subjected to accelerated or decelerated rates of change in photoperiod than in the fish subjected to the normal rate of change in photoperiod. Some of the progeny of the 220 day delayed fish, which were reared under artificial light with the normal rate of change in photoperiod set 220 days out-of-phase, became sexually mature 2 years after they had begun life as fertilized eggs.

80-000800 Ryman, N. and G. Ståhl. GENETIC CHANGES IN HATCHERY STOCKS OF BROWN TROUT (*SALMO TRUTTA*). *Can. J. Fish. Aquatic Sci.* 37(1):82-87. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Genet., Univ. Stockholm, Box 6801, S-113 86 Stockholm, Sweden]

80-000801 Sikora, C. A. A BACTERIOLOGICAL STUDY OF ORGANISMS AFFECTING THE HATCHABILITY OF RAINBOW TROUT (*SALMO GAIRDNERI*) EGGS IN WHITLOCK-VIBERT BOXES. *J. Colo.-Wyo. Acad. Sci.* 12(1):15. Apr. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Colo., Boulder] Recently there has been pressure on state agencies by various fishing groups to implement the use of Whitlock/Vibert boxes in Colorado streams to facilitate a more natural trout population. To study one of the drawbacks of this method, eyed eggs from fall spawning Arlee strain rainbow trout (*Salmo gairdneri*) were obtained from the Fort Collins hatchery in October 1979 and placed in W/V boxes. Thirty-eight boxes were loaded with 554 eggs each at the hatchery and transported to upper Boulder Creek where 27 were buried in a gravel riffle. The other 11 boxes which served as controls were placed in a laboratory stream. Water samples from the hatchery, the laboratory stream, and Boulder Creek were analyzed for specific bacterial content. The total number of organisms per milliliter of water at each site was determined. Following the egg incubation period a bacterial count was conducted on the dead eggs. A comparison was made between the bacterial count from the eggs and the total number of eggs hatched to determine the relationship between the number of bacteria present and the hatchability of the eggs in the W/V boxes. There was a linear relationship between the bacterial content and the percent egg hatchability.

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80-000802 Anonymous. PROGRESS REPORT OF THE FRESHWATER AQUACULTURE CENTER. *Prog. Rep. Freshwater Aquacult. Cent. Cent. Luzon State Univ.* No. 14. v + 62p. 1979. SFA 25(2)

[Freshwater Aquacult. Cent., Cent. Luzon State Univ., Muñoz, Nueva Ecija 2320, Philippines]

80-000803 Beyerle, G. B. EXTENSIVE CULTURE OF WALLEYE FRY IN PONDS AT THE WOLF LAKE HATCHERY, 1975-1978. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1874. 28p. 26 Dec. 1979. SFA 25(2)

[Mich. Dep. Nat. Resour., East Lansing] Over a 4-year period extensive culture techniques were refined so that walleye fry stocked at the rate of 3.5 per cubic meter in naturally fertile ponds at Wolf Lake Hatchery could be raised in 6 to 7 weeks to a mean length of 50 mm with a survival of 90% or more. The principal food item for the walleyes during the entire rearing cycle, *Daphnia pulex*, was maintained best by weekly applications of horse or sheep manure (32 ppm) and torula or brewer's yeast (5.3 ppm). A recommended step-by-step procedure is presented.

80-000804 Cook, A. F. and R. E. Peter. THE EFFECT OF TEMPERATURE ON THE CLEARANCE OF INTRAPERITONEALLY-INJECTED GONADOTROPIN IN THE GOLDFISH *CARASSIUS AURATUS*. *Aquaculture* 19(3):275-285. Mar. 1980. SFA 25(2)

[Zool. Dep., Univ. Alberta, Edmonton, AB T6G 2E9, Canada] The serum half-disapperance time ($t_{\frac{1}{2}}$), metabolic clearance rate and volume of distribution of intraperitonenally administered carp gonadotropin (cGtH) and endogenous GtH levels were determined in sexually mature male and female goldfish, *Carassius auratus* maintained at 12 ± 1°C or 20 ± 1°C. The results indicated that the rate of serum uptake of the injected cGtH from the peritoneal cavity was greater at 20°C than at 12°C in sexually mature male goldfish. Although increased endogenous serum GtH levels and decreased values of serum $t_{\frac{1}{2}}$ were associated with the elevated temperature, there was no difference in any of the parameters between sexually mature male and female goldfish acclimated to 12°C.

80-000805 Flüchter, J. REVIEW OF THE PRESENT KNOWLEDGE OF REARING WHITEFISH (COREGONIDAE) LARVAE. *Aquaculture* 19(2):191-208. Feb. 1980. SFA 25(2)

[Bayer. Landesanst. Fisch., 8130 Starnberg, Weilheimer Str. 8a, West Germany] Intensive fishing of whitefish (*Coregonus lavaretus*) and a survival rate of early stages of the fry that is generally too low lead, at present, to the whitefish stocks not being able to utilize fully the natural food resources now produced many times in excess of the requirements by the eutrophication of lakes. Feeding experiments in aquaria have, for several years, shown very impressively, that there are two main reasons for the high mortality of the larvae in the natural environment:high sensitivity to even a short-term lack of food and specific food requirements--the necessity for the larvae to feed on the juvenile stages of certain zooplanktonic crustaceans. Artificial breeding of whitefish eggs in cold water at 1°C caused a delay in hatching of about 8 weeks compared with natural hatching, thus allowing the release of the larvae at a time when the density of zooplankton is about ten times higher and mainly juvenile stages of crustaceans needed by the whitefish larvae are present. Hence this is one proven way of improving the survival rate of whitefish larvae in the natural environment. Young fish, after metamorphosis, have less specialized food requirements than the larval stage and can even be fed adequately with dry food. In rearing the larvae, natural zooplankton can be replaced by the nauplii of the brine shrimp, *Artemia salina*. Larvae have not yet been reared on dry food or even on slowly frozen zooplankton or *Artemia*, but

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80-000805 CONTINUED *Artemia* nauplii shock-frozen in liquid nitrogen (at -196°C) were found to be as acceptable as living ones and allowed metamorphosis of the larvae to take place. The substance, assumed to be present in the living *Artemia*, which was lost on slow-freezing but retained after shock-freezing and was shown to be essential to the whitefish larvae, was insoluble in water. Biochemical investigation and identification of this substance are urgently required in order to synthesize an artificial complete food for whitefish larvae. As long as this artificial food is not available, attention will have to be focussed on rearing the larvae in natural ponds where the specific and essential zooplankton can be encouraged.

80-000806 Fry, D. L. and J. A. Osborne. ZOOPLANKTON ABUNDANCE AND DIVERSITY IN CENTRAL FLORIDA GRASS CARP PONDS. *Hydrobiologia* 68(2):145-155. 31 Jan. 1980. SFA 25(2)

[Dep. Biol. Sci., Univ. Cent. Fla., Orlando 32816] The effect of the Asian grass carp (*Ctenopharyngodon idella* Val.) upon the zooplankton in three adjacent experimental ponds (0.139 ha each) was studied for one year. The ponds contained nine species of aquatic macrophytes. Grass carp were stocked into Pond I (65 per ha) and Pond 2 (611 per ha) three months after the study was started. At the time of stocking, physicochemical and biological parameters were similar among the ponds. Grass carp did not affect water quality and had little direct or indirect effect upon the zooplankton in the ponds. The abundance and species diversity of zooplankton (number of species, Shannon Index, and Simpson Index) were not significantly different ($P < 0.05$) between ponds prior to grass carp stocking. After stocking with grass carp, the number of species and species diversity were found to be significantly different ($P < 0.05$) between Pond I (low grass carp stocking rate) and Pond 2 (high grass carp stocking rate). Additionally, significant differences ($P < 0.05$) in populations between ponds were found for *Lecane luna*, *Monostyla bulla*, *Lepadella ehrenbergii*, *Polyarthra* sp., and *Synchaeta* sp. Temporal variation rather than grass carp was probably responsible for those differences. The number of zooplankton per group (Rotifera, Cladocera, and Copepoda) and species diversity were not significantly different ($P < 0.05$) between ponds containing different stocking rates of grass carp. During the study, zooplankton were collected with a shallow-water sampler. No significant differences ($P < 0.05$) between collections were found for the sampler and a No. 20 mesh nylon zooplankton net.

80-000807 Halevi, A. OBSERVATIONS ON POLYCULTURE OF FISH UNDER STANDARD FARM POND CONDITIONS AT THE FISH AND AQUACULTURE RESEARCH STATION, DOR, DURING THE YEARS 1972-1977. *Bamidgeh* 31(4):96-104. Dec. 1979. SFA 25(2)

[Fish Aquacult. Res. Stn., Dor, Israel]

80-000808 Hearn, M. THE POND-SPAWNING AND FINGERLING PRODUCTION OF MUSKELLUNGE AT THE MINOR E. CLARK FISH HATCHERY, KENTUCKY, DURING 1973. *Ky. Dep. Fish Wildl. Resour. Fish. Bull.* no. 61. 43p. 1974. SFA 25(2)

[Clark Fish Hatchery, Rt. 4, Morehead, KY 40351]

80-000809 Kulkarni, C. V. and S. N. Ogale. THE PRESENT STATUS OF MAHSEER (FISH) AND ARTIFICIAL PROPAGATION OF *TOR KHUDREE* (SYKES). *J. Bombay Nat. Hist. Soc.* 75(3):651-660. Dec. 1978. SFA 25(2)

[B/4, Shardashram, B. Shankar Rd., Bombay 400 028, India]

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80-000810 von Lukowicz, M. and C. Proske. PRODUCTION AND REPRODUCTION OF TENCH. *Riv. It. Piscic. Ittiop.* 14(4):109-112, 115-116. Oct.-Nov.-Dec. 1979. In English and Italian SFA 25(2)
Bayerische Landesanst. Fisch., 8130 Starnberg, Weilheimer Str. 8a, West Germany]

80-000811 Zur, O. THE APPEARANCE OF CHIRONOMID LARVAE IN PONDS CONTAINING COMMON CARP (*CYPRINUS CARPIO*). *Bamidgeh* 31(4):105-113. Dec. 1979. SFA 25(2)
[Fish Cult. Exp. Stn., Ginosar, P.O. Box 33, Tiberias, Israel] In fish ponds, the predation tension of the Common Carp on chironomid larvae is high. At fish concentrations of 500, 1,000, 4,000 and 10,000 fish/ha, reduction in larval concentration was 83.93, 93.9, 93.69 and 99.82%, respectively. The fish did not exhibit any preferential predation according to size of prey. There was no correlation between the appearance of the larvae and the height of the pond's water column (within the range of 37-90 cm). During the growth season, no fluctuations in rate of egg deposition were observed. The larvae appeared at the bottom of the pond at the rate of 1953 larvae/m^2/day. If the minimal edible size is 0.09 mg, this means daily consumption of 1.75kg/ha. It seems that in commercial fish ponds, chironomid larvae may serve either as growth limiting or growth promoting factors.

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80-000812 Ranoemihardjo, B. S. and A. M. Pirzan. EFFECT OF STOCKING DENSITY ON THE RATE OF GROWTH OF MILKFISH FRY (*CHANOS CHANOS*). *Bull. Brackishwater Aquacult. Dev. Cent. (Jepara)* 3(1-2):247-257. Jan.-July 1977. SFA 25(2)
[Brackishwater Aquacult. Dev. Cent., Jepara, Indonesia] Survival rate of milkfish fry in nursery pond is usually about 20-40%. With intensive preparation, the survival could be increased to about 60-80%. Culture of fry in small compartment is much easier to control and mortality could be reduced. More intensive care and management in the nursery pond makes the fry more healthy, results in higher survival and makes transfer easier to the rearing pond. The result of the experiment in the wooden box as nursery had shown that the fry grew from 14.62 mm in total length and 7.88 mg in weight to an average of 29.49 mm in total length and 180.85 mg in weight or an increment of 14.87 mm and 172.97 mg, respectively, after four weeks rearing. Stocking density ranged from 35 to 95 fry per square meter with an average survival rate of 97 percent.--From abstr.

80-000813 Scholes, P. THE SEA-WATER WELL SYSTEM AT THE FISHERIES LABORATORY, LOWESTOFT AND THE METHODS IN USE FOR KEEPING MARINE FISH. *J. Mar. Biol. Assoc. UK* 60(1):215-225. Feb. 1980. SFA 25(2)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, England]

80-000814 Tatum, W. M.; W. C. Trimble and R. F. Helton, Jr. PRODUCTION OF GULF KILLIFISH IN BRACKISH-WATER PONDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:502-508. 1978[1979]. SFA 25(2) Claude Peteet Maricult. Cent., Ala. Dep. Conserv. Nat. Resour., Gulf Shores 36542] Production of gulf killifish (*Fundulus grandis*) was investigated from 17 November 1977 to 10 July 1978 in 0.08 ha, brackish-water, earthen ponds at the Claude Peteet Mariculture Center. Gulf killifish averaging 30.7 g and stocked at 12,500 fish/ha deposited eggs on Spanish moss spawning mats from 21 March through 16 May 1978. Fifty mats with eggs were transferred to a hatching pond which yielded 82,500 juvenile killifish averaging 0.1 g at harvest on 16 May. Stocked at 250,000 fish/ha in 3 grow-out ponds on 19 May and fed a commercial minnow feed, the juveniles averaged 2.0 g (marketable

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80-000814 CONTINUED size) on 10 July 1978 with mean survival of 82%, feed conversion of 1.9, and production of 427 kg/ha.

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80-000815 Abel, H.; A. Pieper and E. Pfeffer. UNTERSUCHUNGEN AN WACHSENDEN REGENBOGENFORELLEN (SALMO GAIRDNERI, R.) ÜBER DIE INTERMEDIÄRE ANPASSUNG AN PROTEIN ODER KOHLENHYDRATE ALS ENERGIETRÄGER IM FUTTER. [STUDIES ABOUT METABOLIC ADAPTATIONS OF RAINBOW TROUT (SALMO GAIRDNERI, R.) TO PROTEIN OR CARBOHYDRATES AS SOURCES OF DIETARY ENERGY. *J. Anim. Physiol. Anim. Nutr.* 41(6):325-334. May 1979. In German with English summ. SFA 25(2)
[Inst. Tierphysiol. Tierernährung, Univ. Göttingen, West Germany]

80-000816 Atack, T. H.; K. Jauncey and A. J. Matty. THE UTILIZATION OF SOME SINGLE CELL PROTEINS BY FINGERLING MIRROR CARP (*CYPRINUS CARPIO*). *Aquaculture* 18(4):337-348. Dec. 1979. SFA 25(2)
[Fish Farm Development International, Stronachullin, Ardrishaig, Argyll, Scotland] An experiment was conducted to determine the utilization by mirror carp of yeast (PY), bacterial (MB), algal (SA), soybean (SY), casein (CS), and herring (HM) meal proteins as the sole protein sources in semi-purified rations. A low casein (CS LOW) diet was included in the trial so that true digestibility, Net Protein Utilization (NPU) and Biological Values (BV) could be determined. All the feeds contained 30% protein other than the fishmeal and bacterial diets which contained 25 and 35%, respectively. Specific growth rates (%/day) found were MB 2.78 >CS 2.4, HM 2.26 > PY 2.08 > SY 1.24, SA 1.18 and CS LOW 1.13. Food conversion was optimal with diet MB (1.14) followed by CS (1.39), HM (1.42), PY (1.55) < SA (2.50) < SY (2.86) and CS LOW (3.04). Protein efficiency ratio was highest with the low casein diet at 3.24 decreasing in the order HM 2.82, CS 2.48 > PY 2.08 > SY 1.35 and SA 1.15. All the test proteins were well digested, assimilation values ranging from 80.3% (HM diet) to 96.6% (PY diet). The NPU's and BV's calculated from body analysis data were respectively for each protein, HM 64 and 79%, MB 49 and 52%, CS 49 and 52%, PY 47 and 49%, SY 42 and 51%, SA 36 and 41%. The above biological values are compared with various chemical scores based on amino acid analysis of the test proteins. All the results are discussed fully and also compared to values previously obtained with identical diets in rainbow trout experiments.

80-000817 Biette, R. M. THE EFFECT OF TEMPERATURE AND RATION ON GROWTH RATES, FOOD CONVERSION EFFICIENCIES AND THE FATE OF CARBON-14 LABELLED FOOD BY UNDER-YEARLING SOCKEYE SALMON, *ONCORHYNCHUS NERKA*. *Ph.D. dissertation, Simon Fraser Univ. (Canada)* 1978. From Diss. Abstr. Int. B Sci. Eng. 40(9):4078. Mar. 1980. SFA 25(2)
It is concluded that young sockeye ingesting moderate rations comparable to those probably available in the relatively warm surface layers of Babine Lake, and living under a thermal regime which involves twice daily migrations from deep cold waters to the surface and return, are likely to grow more rapidly and efficiently than fish maintained at constant temperatures. This suggests a possible selective value for vertical migrations in thermally stratified waters.--From abstr.

80-000818 Dahlgren, B. T. THE EFFECTS OF THREE DIFFERENT DIETARY PROTEIN LEVELS ON THE FECUNDITY IN THE GUPPY, *POECILIA RETICULATA* (PETERS). *J. Fish Biol.* 16(1):83-97. Jan. 1980. SFA 25(2)

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80-000818 CONTINUED
[Dep. Anim. Ecol., Univ. Lund, Ecology Bldg., S-223 62 Lund, Sweden] Experiments were performed to investigate the influences of dietary protein on fecundity in the guppy, *Poecilia reticulata*. No significant differences in total body length and standard length were found between females given food with different protein levels. A significantly higher total body weight was found both in females fed on 47% and 31% protein compared with females given 15% protein. The frequencies of females with only intrafollicular embryos or with only ova or both embryos and ova in the ovary were not significantly different between populations given different protein amounts. There was a significantly lower frequency of females without embryos and ova but with previtellogenic oocytes in the group given highest protein (47%) compared with the group fed on 31%. Significantly higher values of ovarian length, width and gonad weight were found among females given 47% protein compared with females fed on 15% protein. The ovarian height was significantly higher only in females given the highest protein amount when compared with the group fed on 31% protein. No significant difference of ovarian volume was found between groups given different protein contents. The average gonadosomatic ratio was highest in the groups fed on 47% protein. Significant correlations were found between gonad weight and total body weight of females in each group. Ovarian volume versus total body weight as well as differences of fecundity were found either between females given 47% and 31% protein or between females fed on 47% and 15% protein. A somewhat higher number of ova per individual fish was, however, observed among females given 31% when compared with females fed on 15% protein. The ovum size remained the same between groups given different protein contents. No significant correlation was found between fecundity and ovum diameter in the groups.

80-000819 Felts, S. K. EVALUATION OF SUPPLEMENTAL DIETS FOR GOLDEN SHINERS SHINERS. *Ph.D. dissertation, Auburn Univ.* 68p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5):1971. Nov. 1979. SFA 25(2)
Golden shiners averaging 0.18 g/fish were stocked into twelve 0.04-hectare (0.1-acre) earthen ponds at the rate of 240,000 fish/ha (97,000 fish/a). The fish were managed for an 86-day period according to the following treatments: 1) no feed but the ponds were fertilized (45 cm maximum Secchi visibility); 2) fed an all-plant meal diet; 3) fed a meal diet containing 10 percent fish meal; and 4) fed a meal diet containing 20 percent fish meal. The shiners that were not fed weighed 465.4 kg/ha at harvest, while the fed shiners weighed 687.1, 713.5, and 744.9 kg/ha for the all-plant, 10 percent fish meal diet, and 20 percent fish meal diets, respectively. Although additions of fish meal made slight improvements in growth, there was no significant difference ($P < .05$) in weight gain among the fed treatments. Feed conversion ratios were 1.6 to 1.7 and 91 to 100 percent of the fish were larger than 5 cm in length. Digestive tract analyses revealed that the major food of the nonfed shiners was phytoplankton. An economic evaluation of returns above feed, fertilizer, and labor costs showed $1202/ha for the nonfed fish and $1564/ha to $1647/ha for the fed fish. Golden shiners fed the 10 percent fish meal diet in flowing-water aquariums (100 fish/38-liter aquarium) concurrently with those fed the same diet in ponds only gained 14.7 as much weight as the fish in the ponds. This is due to the absence of natural pond organisms and the loss of water soluble nutrients from a meal diet before they can be consumed by the fish.--From abstr.

80-000820 Freed, P. L. EVALUATION OF THE COEFFICIENT OF DIGESTIBILITY OF HERRING MENHADEN, TUNA, ANCHOVY, AND SOYBEAN MEALS BY RAINBOW TROUT (*SALMO GAIRDNERI*). *J. Colo.-Wyo. Acad. Sci.* 12(1):17. Apr. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Colo., Boulder] The purpose of this study was to compare the coefficient of digestibility of four different meals, and diets

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80-000820 CONTINUED containing isonitrogenous levels of the meals to the Federal PR 11 control diet containing herring meal. Digestibility coefficients were computed for the major nutrients in the diets (protein and fat). Replicate groups of yearling rainbow trout, *Salmo gairdneri*, were fed the meals, the experimental diets, and the control diet after they were ground, mixed with chromic oxide marker, and repelleted. The meals, experimental diets, control diet, and feces were proximately analyzed according to standard methods. Fecal samples were collected by the anal suction method to eliminate leaching of nutrients into the water. All data were analyzed with the appropriate statistical tests. Proximate analysis of the meals indicated that organic matter content ranged from 69.5% for tuna meal to 85.7% for soya meal. Capelin, herring, anchovy, and menhaden meals were 83, 74, 77, and 76% organic matter, respectively. Fat contents ranged from 2.5% for soya to 11.5% for capelin meal. Anchovy, herring, menhanden and tuna had 9.5, 8.0, 9.3, and 5.5% fat content, respectively. Protein content ranged from a high of 72% for capelin meal to a low of 41% for soya meal.

80-000821 Gulley, D. D. EFFECT OF MINERAL ASH CONTENT ON ATLANTIC MENHADEN MEAL (*BREVOORTIA TYRANNUS*) DIGESTIBILITY BY RAINBOW TROUT (*SALMO GAIRDNERI*). *J. Colo.-Wyo. Acad. Sci.* 12(1):17. Apr. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Colo., Boulder] The purpose of this study was to determine the coefficient of digestibility of commercial Menhaden meal containing either 18.8%, 21.5%, 23.8% or 26.3% levels of mineral ash. The control (18.8%) and experimental rations were mixed with the inert marker chromic oxide, pelleted into 1/8" pellets, and fed to yearling rainbow trout (Arlee strain) held in 10 C water. Percent protein nitrogen was estimated by the micro-Kjeldahl method, total lipids by reflux distillation with petroleum ether. Chromic oxide was measured by the wet acid digestion method of Furukawa and Tsukahara. The coefficient of digestibility for dry matter decreased as the ash content increased from 18.8% to 26.3%. Protein and fat digestibilities also decreased as ash content increased.

80-000822 Kaushik, S. J. and P. Luquet. INFLUENCE OF BACTERIAL PROTEIN INCORPORATION AND OF SULPHUR AMINO ACID SUPPLEMENTATION TO SUCH DIETS ON GROWTH OF RAINBOW TROUT, *SALMO GAIRDNERII* RICHARDSON. *Aquaculture* 19(2):163-175. Feb. 1980. SFA 25(2)

[Lab. Nutr. Poissons, I.N.R.A., Cent. Rech. Hydrobiol., B.P3, Saint Pée-sur-Nivelle, 64310 Ascain, France]

80-000823 Kitajima, C.; M. Yoshida and T. Watanabe. [DIETARY VALUE FOR AYU *PLECOGLOSSUS ALTIVELIS* OF ROTIFER *BRACHIONUS PLICATILIS* CULTURED WITH BAKER'S YEAST *SACCHAROMYCES CEREVISIAE* SUPPLEMENTED WITH CUTTLEFISH LIVER OIL.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):47-50. Jan. 1980. In Japanese with English summ. SFA 25(2)

[Aquacult. Res. Lab., Nagasaki Pref. Inst. Fish., Nomozaki, Nagasaki 851-05, Japan]

80-000824 Kitajima, C.; T. Arakawa, F. Oowa; S. Fujita; O. Imada; T. Watanabe and Y. Yone. [DIETARY VALUE FOR RED SEA BREAM LARVAE OF ROTIFER *BRACHIONUS PLICATILIS* CULTURED WITH A NEW TYPE OF YEAST.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):43-46. Jan. 1980. In Japanese with English summ. SFA 25(2)

[Aquacult. Res. Lab., Nagasaki Pref. Inst. Fish., Nomozaki, Nagasaki 851-05, Japan]

FEEDS, FEEDING, AND NUTRITION

80-000825 Mahajan, C. L. and N. K. Agrawal. THE ROLE OF VITAMIN C IN CALCIUM UPTAKE BY FISH. *Aquaculture* 19(3):287-294. Mar. 1980. SFA 25(2)
[Fish Biol. Lab., Dep. Zool., Univ. Rajasthan, Jaipur-3 02004, India] Calcium uptake in experimentally induced scorbutic snake heads, *Channa (=Ophicephalus) punctatus*, fed vitamin C-deficient diet for 210 days is reported, using ^{45}Ca as tracer. When compared with a parallel control on completely synthetic diet, the results show decreased absorption and utilization of calcium by gill, skin, muscle and bone of scorbutic fish from surrounding water. The physiological significance of these results is discussed, and its practical utility in aquaculture is indicated.

80-000826 Mahajan, C. L. and N. K. Agrawal. VITAMIN C DEFICIENCY IN *CHANNA PUNCTATUS* BLOCH. *J. Fish Biol.* 15(5):613-622. Nov. 1979. SFA 25(2)
[Fish Biol. Lab., Dep. Zool., Univ. Rajasthan, Jaipur-302004, India] The results of a series of experiments on *Channa punctatus* previously conditioned to a complete synthetic diet and later fed vitamin C deficient diet for 210 days followed by 30 days of recovery with fortified vitamin C ration are reported. The survival, growth, morphological abnormalities and biochemical changes in tissue ascorbic acid and cholesterol levels were studied. Deficiency of vitamin C resulted in a mortality of up to 25% and retarded growth accompanied by anorexia and loss of weight. Marked skeletal abnormalities, *viz.*, lordosis, scoliosis and degenerative changes in the thoracic vertebrae were revealed by X-ray studies. Biochemical investigations showed a significant decrease in blood and kidney ascorbic acid levels within a month of feeding the deficient diet. A prolonged deficiency beyond 150 days resulted in a rapid rise in the cholesterol content of the liver. These biochemical changes were reversed when vitamin C was added to the ration.

80-000827 Nakashima, B. S. and W. C. Leggett. NATURAL SOURCES AND REQUIREMENTS OF PHOSPHORUS FOR FISHES. *Can. J. Fish. Aquatic Sci.* 37(4):679-686. Apr. 1980. SFA 25(2)
[Biol. Dep., McGill Univ., 1205 Ave. Docteur Penfield, Montreal, PQ H3A 1B1, Canada]

80-000828 Ogino, C. and H. Nanri. [RELATIONSHIP BETWEEN THE NUTRITIVE VALUE OF DIETARY PROTEINS FOR RAINBOW TROUT AND THE ESSENTIAL AMINO ACID COMPOSITIONS.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):109-112. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000829 Ogino, C.; L. Takeuchi; H. Takeda and T. Watanabe. [AVAILABILITY OF DIETARY PHOSPHORUS IN CARP AND RAINBOW TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1527-1532. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000830 Ota, T.; T. Takagi; R. Odajima and T. Terao. [EFFECT OF DIETARY LIPIDS ON GROWTH AND LIPIDS OF COHO SALMON, *ONCORHYNCHUS KISUTCH*. *Bull. Fac. Fish. Hokkaido Univ.* 30(4):294-300. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Chem. Fish Oil, Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

FEEDS, FEEDING, AND NUTRITION

80-000831 Pozar, D. F. AUTOMATIC FISH FOOD DISPENSER FOR USE WITH OREGON MOIST AND DRY FOOD PELLETS. *Prog. Fish-Cult.* 42(1):45-48. Jan. 1980. SFA 25(2)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-000832 Reagan, R. E. and H. R. Robinette. FEEDING OF CHANNEL CATFISH FINGERLINGS IN MILD AND SEVERE WINTERS IN MISSISSIPPI. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:426-428. 1978[1979]. SFA 25(2)
[Dep. Wildl. Fish., Miss. State Univ., Mississippi State 39762] A feeding study with channel catfish fingerlings (*Ictalurus punctatus*) was conducted in the winters 1975-76 and 1977-78, a mild and severe winter, respectively. In both years, fish in 3 ponds were fed 3 days per week and fish in 3 ponds were fed 6 days per week. In the 1975 study, fish fed 3 and 6 days per week averaged 10% and 45% weight gain with a mean feed conversion of 2.63 and 2.90, respectively; fish fed 6 days per week had significantly ($P<.10$) greater weight gains than the fish fed 3 days per week. In 1977 fish fed 3 days per week gained an average of 24% and had a mean conversion of 1.98. Fish fed 6 times per week had an average weight gain of 29% and a mean feed conversion of 2.50. This was not significantly ($P<.10$) different than the fish fed 3 days per week.

80-000833 Reinitz, G. and F. Hitzel. FORMULATION OF PRACTICAL DIETS FOR RAINBOW TROUT BASED ON DESIRED PERFORMANCE AND BODY COMPOSITION. *Aquaculture* 19(3):243-252. Mar. 1980. SFA 25(2)
[U.S. FWS, Spearfish Fish. Cent., Rt. 1, Box 205, Spearfish, SD 57783] Rainbow trout (*Salmo gairdneri*) with an initial average weight of 1.8 g were fed eight experimental diets with 26 and 35% protein and varying amounts of lipid for 112 days. All experimental diets contained 10% fish meal (the only source of animal protein), as compared to a control diet with 35% fish meal. The energy content of the diet was the most important factor in determining growth rate. The percentage of dietary lipid was the dominant factor in determining the body composition of rainbow trout. Increased amounts of dietary lipid resulted in fish with increased amounts of whole-body fat and reduced amounts of whole-body protein and moisture. Body composition was more closely a function of nutritional history than of fish size. Protein retention and energy retention were negatively associated with the percentage of digestible protein in the diet. Mortality rates did not differ significantly among the groups tested; the general health of all fish examined was good.

80-000834 Reinitz, G. and R. Austin. EXPERIMENTAL DIETS FOR INTENSIVE CULTURE OF YELLOW PERCH. *Prog. Fish-Cult.* 42(1):29-31. Jan. 1980. SFA 25(2)
[U.S. FWS, Rt. 1, Box 205, Spearfish, SD 57783]

80-000835 Sakamoto, S.; A. Eto; M. Furuichi and Y. Yone. PURIFIED TEST DIET FOR YELLOWTAIL--I. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1179-1183. Sept. 1979. SFA 25(2)
[Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka 811-33, Japan] This study was conducted to formulate a purified test diet for yellowtail, *Seriola quinqueradiata*. Yellowtail fingerlings were fed on a purified diet or a diet of minced jack mackerel over a 60 day period. At the end of the feeding trial, anatomico-pathological and histopathological examinations of the tissues, hematological examinations, and chemical analyses of the dorsal muscle, liver, and vertebrae were performed. Significant differences were recognized between the two groups in appetite, growth rate, and other factors, and the jack mackerel group were found superior to those of the purified diet group. However, the low mortality and comparatively high feed efficiency indicate that a purified test diet for yellowtail can be established after adequate modification of the present diet.

FEEDS, FEEDING, AND NUTRITION

80-000836 Sampath, K. and T. J. Pandian. EFFECTS OF DENSITY ON FOOD UTILIZATION AND SURFACING BEHAVIOUR IN THE OBLIGATORY AIR-BREATHING FISH *CHANNA STRIATUS*. *Hydrobiologia* 68(2):113-117. 31 Jan. 1980. SFA 25(2)
[Sch. Biol. Sci., Madurai Kamaraj Univ., Madurai 625021, India] Rearing *Channa striatus* in groups of 1, 2, 4, 8 or 16 individuals/aquarium, effects of density on food utilization and surfacing behaviour were studied. Individuals in the control group consumed more but converted less efficiently. Those reared in higher densities too consumed less and converted far less efficiently, spending greater amount of energy on surfacing. At the optimum density of 4 individuals/aquarium, the fish consumed the highest ration and converted it with maximum efficiency, conserving energy by decreased surfacing activity. Growth of smaller individuals is inhibited in the presence of larger ones at all the tested densities. The inhibition is minimum at the optimum density and is maximum at the densities of 2 and 16 individuals/aquarium. Individuals reared in the maximum density produced maximum but the mean body weight of a single individual was only half of that in the optimum density. The optimum density, which yields maximum production without sacrificing mean body weight, is profitable for aquaculture.

80-000837 Takeuchi, T. and T. Watanabe. [EFFECT OF EXCESS AMOUNTS OF ESSENTIAL FATTY ACIDS ON GROWTH OF RAINBOW TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1517-1519. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000838 Takeuchi, T.; T. Watanabe and T. Nose. [REQUIREMENT FOR ESSENTIAL FATTY ACIDS OF CHUM SALMON (*ONCORHYNCHUS KETA*) IN FRESHWATER ENVIRONMENT]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1319-1323. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000839 Tomiyama, T.; J. L. Sumner; G. W. Kitson and I. R. Perry. FATTENING OF WILD SHORT-FINNED EELS, *ANGUILLA AUSTRALIS SCHMIDTII* PHILLIPS. *N. Z. Nar. Freshwater Res.* 13(3):377-378. 1979. SFA 25(2)
[Tokyo Univ. Fish., Tokyo, Japan] Short-finned wild eels fed an artificial diet containing either a low (5%) or a high (20%) oil content were found to increase their mass by an average of more than 30% after a 34-day feeding period; the lipid content of the eels' muscle was also increased from about 10% to around 20%.

80-000840 Viola, S. and U. Rappaport. THE "EXTRA-CALORIC EFFECT" OF OIL IN THE NUTRITION OF CARP. *Bamidgeh* 31(3):51-68. Sept. 1979. SFA 25(2)
[Miloubar, D. N. Ashrat, Israel]

80-000841 Watanabe, T.; F. Oowa; C. Kitajima and S. Fujita. RELATIONSHIP BETWEEN DIETARY VALUE OF BRINE SHRIMP *ARTEMIA SALINA* AND THEIR CONTENT OF ω3 HIGHLY UNSATURATED FATTY ACIDS. *Bull. Jpn. Soc. Sci. Fish.* 46(1):35-41. Jan. 1980. SFA 25(2)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000842 Yingst, W. L. III and R. R. Stickney. GROWTH OF CAGED CHANNEL CATFISH FINGERLINGS REARED ON DIETS CONTAINING VARIOUS LIPIDS. *Prog. Fish-Cult.* 42(1):24-26. Jan. 1980. SFA 25(1)

FEEDS, FEEDING, AND NUTRITION

80-000842 CONTINUED
[N. J. Dep. Transport., Bur. Environ. Anal., 1035 Parkway Ave., Trenton 08625]

80-000843 Yingst, W. L. III and R. R. Stickney. EFFECTS OF DIETARY LIPIDS ON FATTY ACID COMPOSITION OF CHANNEL CATFISH FRY. *Trans. Am. Fish. Soc.* 108(6):620-625. Nov. 1979. SFA 25(2)
[N.J. Dep. Transportation, Bur. Environ. Anal., 1035 Parkway Ave., Trenton 08624]

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

80-000844 Baynes, S. M.; L. Emerson and A. P. Scott. CULTURE OF ALGAE FOR LARVAL FISH AND SHELLFISH REARING. PART 3. PRODUCTION OF ALGAE FOR USE IN THE REARING OF LARVAL FISH. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 53. p. 13-18. 1979. SFA 25(2)
[Fish. Lab., Lowestoft, England]

80-000845 Buynak G. L. and H. W. Mohr, Jr. COLLAPSIBLE FISH-HOLDING CAGE. *Prog. Fish-Cult.* 42(1):41-42. Jan. 1980. SFA 25(1)
[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603]

80-000846 Helm, M. M.; I. Laing and E. Jones. CULTURE OF ALGAE FOR LARVAL FISH AND SHELLFISH REARING. PART 1. THE DEVELOPMENT OF A 200 L. ALGAL CULTURE VESSEL AT CONWY. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 53. p. 1-7. 1979. SFA 25(2)
[Fish. Exp. Stn., Conwy, England]

80-000847 Laing, I. CULTURE OF ALGAE FOR LARVAL FISH AND SHELLFISH REARING Part II. RECOMMENDED PROCEDURES FOR THE CULTURE OF *CHAETOCEROS CALCITRANS*. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 53. p. 8-12. 1979. SFA 25(2)
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80-000848 Parker, N. C. and G. A. Jackson. EXTERNAL STANDPIPE DRAIN SYSTEM FOR FISH TANKS. *Prog. Fish-Cult.* 42(1):53-54. Jan. 1980. SFA 25(1)
[U.S. FWS, P.O. Box 936, LaCrosse, WI 54601]

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-000849 Qasim, S. Z. OCEANOGRAPHIC RESEARCH IN INDIA--PAST, PRESENT AND FUTURE. *J. Bombay Nat. Hist. Soc.* 75(3):661-667. Dec. 1978. SFA 25(2)
[Natl. Inst. Oceanogr., Dona Paula, Goa 403 004, India]

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-000850 Short, R. A. and J. V. Ward. LEAF LITTER PROCESSING IN A REGULATED ROCKY MOUNTAIN STREAM. *Can. J. Fish. Aquatic Sci.* 37(1):123-127. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

80-000851 Vannote, R. L.; G. W. Minshall; K. W. Cummins; J. R. Sedell and C. E. Cushing. THE RIVER CONTINUUM CONCEPT. *Can. J. Fish. Aquatic Sci.* 37(1):130-137. Jan. 1980. In English with French summ. SFA 25(2)
[Stroud Water Res. Cent., Acad. Nat. Sci. Phila., Avondale, PA 19311]

80-000852 Watson, J., (ed.). SPECIAL ISSUE ON THE EXPERIMENTAL LAKES AREA. *Can. J. Fish. Aquatic Sci.* 37(3):311-558. Mar. 1980. SFA 25(2)
A collection of papers.--RS

PHYSICAL LIMNOLOGY AND OCEANOGRAPHY

80-000853 Volohonsky, H.; E. Shmain and S. Serruya. LAKE KINNERET WATER BIOTOPES: A MATHEMATICAL MODEL OF THERMAL STRATIFICATION FOR ECOLOGICAL PURPOSES. *Ecol. Model.* 9(2):91-120. Mar. 1980. SFA 25(2)
[Kinneret Limnol. Lab., P.O. Box 345, Tiberias, Israel]

CHEMICAL LIMNOLOGY AND OCEANOGRAPHY

80-000854 Bédard, J.; J. C. Therriault and J. Bérubé. ASSESSMENT OF THE IMPORTANCE OF NUTRIENT RECYCLING BY SEABIRDS IN THE ST. LAWRENCE ESTUARY. *Can. J. Fish. Aquatic Sci.* 37(4):583-588. Apr. 1980. SFA 25(2)
[Dep. Biol., Fac. Sci. Gen., Univ. Laval, Ste-Foy, PQ G1K 7P4, Canada]

80-000855 Ben-Yaakov, S. A PORTABLE DISSOLVED OXYGEN ANALYZER FOR THE FISH FARMING INDUSTRY. *Bamidgeh* 31(3):69-77. Sept. 1979. SFA 25(2)
[Dep. Elec. Eng., Ben-Gurion Univ. Negev, Beer-Sheva, Israel]

80-000856 Boyd, C. E. RELIABILITY OF WATER ANALYSIS KITS. *Trans. Am. Fish. Soc.* 109(2):239-243. Mar. 1980. SFA 25(2)
[Auburn Univ., Agric. Exp. Stn., Auburn, AL 36830]

80-000857 Charlton, M. N. OXYGEN DEPLETION IN LAKE ERIE: HAS THERE BEEN ANY CHANGE? *Can. J. Fish. Aquatic Sci.* 37(1):72-81. Jan. 1980. In English with French summ. SFA 25(2)
[Natl. Water Res. Inst., P.O. Box 5050, Burlington, ON L7R 4A6, Canada]

80-000858 Weber, S. EVALUATING THE ACCURACY OF BIOCHEMICAL OXYGEN DEMAND AND SUSPENDED SOLIDS ANALYSES PERFORMED BY WISCONSIN LABORATORIES. *Wis. Dep. Nat. Resour. Tech. Bull.* No. 114. 15p. 1979. SFA 25(2)
[Bur. Water Qual., Wis. Dep. Nat. Resour., Madison]

80-000859 White, E. and G. Payne. DISTRIBUTION AND BIOLOGICAL AVAILABILITY OF REACTIVE HIGH MOLECULAR WEIGHT PHOSPHORUS IN NATURAL WATERS IN NEW ZEALAND. *Can. J. Fish. Aquatic Sci.* 37(4):664-669. Apr. 1980. SFA 25(2)
[Dep. Sci. Indus. Res., P.O. Box 415, Taupo, New Zealand]

BENTHOS

80-000860 Bednarik, A. F. and W. P. McCafferty. BIOSYSTEMATIC REVISION OF THE GENUS *STENONEMA* (EPHEMEROPTERA: HEPTAGENIIDAE). *Can. Bull. Fish. Aquatic Sci.* 201: vi + 73p. 1979. SFA 25(2)
[Dep. Biol., Univ. Utah, Salt Lake City 84112]

80-000861 Cooper, C. M. EFFECTS OF ABNORMAL THERMAL STRATIFICATION ON A RESERVOIR BENTHIC MACROINVERTEBRATE COMMUNITY. *Am. Midl. Nat.* 103(1):149-154. Jan. 1980. SFA 25(2)
[U.S. Dep. Agric., Sedimentation Lab., Univ. Miss., Oxford 38655] The benthos of Grenada Reservoir, Mississippi, was examined during 1973-1976, when periods of flooding caused abnormally high water levels. The increased water levels resulted in prolonged abnormal hypolimnial stagnation due to lack of normal reservoir drawdown procedures. The stagnation in 1973 caused massive kills of immature *Hexagenia bilineata* and *Oecetis inconspicua* larvae in the reservoir conservation pool. Recolonization of the reservoir in 1974 by *Hexagenia* and *Oecetis* was unsuccessful due to recurrence of stagnation. The lengthy stagnation changed the structure of the benthic community, and the *Hexagenia-Oecetis-Chaoborus*-Chironomidae community was replaced by a *Limnodrilus-Chaoborus*-Chironomidae community. Production initially decreased but later recovered.

80-000862 Wefring, D. R. and J. C. Teed. DEVISE FOR COLLECTING REPLICATE ARTIFICIAL SUBSTRATE SAMPLES OF BENTHIC INVERTEBRATES IN LARGE RIVERS. *Prog. Fish-Cult.* 42(1):26-28. Jan. 1980. SFA 25(2)
[Environ. Sci. Div., Inst. Paper Chem., 1043 E. South River St., Appleton, WI 54912]

PLANKTON

80-000863 Sameoto, D. D.; L. O. Jaroszynski and W. B. Fraser. BIONESS, A NEW DESIGN IN MULTIPLE NET ZOOPLANKTON SAMPLERS. *Can. J. Fish. Aquatic Sci.* 37(4):722-724. Apr. 1980. SFA 25(2)
[Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada]

MORPHOLOGY

80-000864 Arthur, D. K. DIFFERENCES IN HEART SIZE BETWEEN OCEAN-CAUGHT AND LABORATORY-GROWN LARVAE OF THE NORTHERN ANCHOVY, *ENGRAULIS MORDAX* GIRARD *J. Exp. Mar. Biol. Ecol.* 43(2):99-106. 6 Mar. 1980. SFA 25(2)
[Dep. Fish., 25 Grenfell St., Adelaide, 5000 South Australia, Australia]

80-000865 Barber, V. C. and C. J. Emerson. SCANNING ELECTRON MICROSCOPIC OBSERVATIONS ON THE INNER EAR OF THE SKATE, *RAJA OCELLATA*. *Cell Tissue Res.* 205(2):199-215. Feb. 1980. SFA 25(2)
[Dep. Biol., Memorial Univ. Newfoundland, St. John's, NF A1B 3X9, Canada]

80-000866 Batten, T. F. C. and J. N. Ball. ULTRASTRUCTURE OF HYPOPHYSIOTROPIC CENTRES IN THE HYPOTHALAMUS OF *POECILIA LATIPINNA* (TELEOSTEI). *Gen. Comp. Endocrinol.* 40(3):352. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Sheffield, England]

MORPHOLOGY

80-000867 Boehlert, G. W. RETINAL DEVELOPMENT IN POSTLARVAL THROUGH JUVENILE *SEBASTES DIPLOPROA*: ADAPTATIONS TO A CHANGING PHOTIC ENVIRONMENT. *Rev. Can. Biol.* 38(4):265-280. Dec. 1979. In English with French summ. SFA 25(2)
[Scripps Inst. Oceanogr., La Jolla, CA 92093]

80-000868 Braekevelt, C. R. FINE STRUCTURE OF THE RETINAL PIGMENT EPITHELIUM IN THE MUD MINNOW (*UMBRA LIMI*). *Can. J. Zool.* 58(2):258-265. Feb. 1980. In English with French summ. SFA 25(2)
[Dep. Anat., Univ. Manitoba, Winnipeg, MB R3E 0W3, Canada]

80-000869 Brummett, A. R. and J. N. Dumont. INITIAL STAGES OF SPERM PENETRATION INTO THE EGG OF *FUNDULUS HETEROCLITUS*. *J. Exp. Zool.* 210(3):417-434. Dec. 1979. SFA 25(2)
[Dep. Biol., Oberlin Coll., Oberlin, OH 44074]

80-000870 Bugayev, V. F. USING THE STRUCTURE OF ZONES OF CONVERGED SCLERITES ON SCALES AS A CRITERION FOR THE DIFFERENTIATION OF LOCAL GROUPINGS OF THE SOCKEYE SALMON, *ONCORHYNCHUS NERKA*, OF THE KAMCHATKA RIVER BASIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):733-743. 1978. SFA 25(2)
[KOTINRO, Petropavlovsk-Kamchatskiy, USSR] The structure of annular and supplementary rings on the scales of spawners of the sockeye, *Oncorhynchus nerka*, in the Kamchatka River basin are studied. The number of converged sclerites in the annuli varies from 0-8, 0-1 being most characteristic of spring-fed waters, 1-2 for rivers and small lakes, and 3-4 for deep lakes. The number of converged sclerites in supplementary rings varies from 0 to 4, among which two types of zones of converged sclerites can be distinguished containing in the main 0 and 2 sclerites. For the division of annuli into river (0-2 sclerites) and lake (3-8 sclerites) the structure of the zone of converged sclerites can be used as the main criterion for the differentiation of fish, the young of which had fed in deep lakes. An analysis of differences from year to year in the structure of annuli confirms this conclusion.

80-000871 Burggren, W.; J. Dunn and K. Barnard. BRANCHIAL CIRCULATION AND GILL MORPHOMETRICS IN THE STURGEON *ACIPENSER TRANSMONTANUS*, AN ANCIENT CHONDROSTEIAN FISH. *Can. J. Zool.* 57(11):2160-2170. Nov. 1979. In English with French summ. SFA 25(2)
[Dep. Zool., Univ. Mass., Amherst 01003]

80-000872 Capapé, C. and M. Desoutter. ETUDE MORPHOLOGIQUE DES PTÉRYGOPODES DE *TORPEDO (TORPEDO) MARMORATA* RISSO, 1810 (PISCES, TORPEDINIDAE). [THE MORPHOLOGY OF THE CLASPERS OF *TORPEDO (TORPEDO) MARMORATA* RISSO, 1810 (PISCES, TORPEDINIDAE).] *Neth. J. Zool.* 29(3):443-449. Sept. 1979. In French with English summ. SFA 25(2)
[U.S.T.L., 34060 Montpellier, France]

80-000873 Carmichael, G. J. SCALE NUMBER DIFFERENCES IN *CAMPOSTOMA* (RAFINESQUE) REARED AT DIFFERENT TEMPERATURES. *J. Tenn. Acad. Sci.* 55(2):54-55. Apr. 1980. Abstract only. SFA 25(2)
[Memphis State Univ., Memphis, TN] Breeding and rearing experiments were conducted to determine whether temperature differentials during development affected the lateral line scale number in the freshwater cyprinid

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80-000873 CONTINUED *Campostoma anomalum pullum*. The progeny of four parental crosses were reared at three different temperatures (13.9°C, 17.7°C, 24.3°C). The lateral line scale number in the genus *Campostoma* was found to be influenced by temperature. *Campostoma* raised at a lower mean temperature (13.9°C ± 1.5°) had significantly (P=.01) more scales (x=47.59) in the lateral line series than those of the same crosses raised at a higher mean temperature (24.3°C ± 1.5°C)(x=44.71). Based on meristic characters (including scale number) several subspecies of *Campostoma anomalum* have been recognized. One of these subspecies (*Campostoma anomalum oligolepis*) has recently been elevated to species rank (*Campostoma oligolepis*). In part this elevation in rank is based on lateral line scale number. Due to the effect of temperature on the lateral line scale number in *Campostoma*, it would seem best to refer to specimens of the genus *Campostoma* in the binomial, i.e., *Campostoma anomalum* until the questions concerning meristic basis for taxonomic designation are answered.

80-000874 Carscadden, J. E. and R. K. Misra. MULTIVARIATE ANALYSIS OF MERISTIC CHARACTERS OF CAPELIN (*MALLOTUS VILLOSUS*) IN THE NORTHWEST ATLANTIC. *Can. J. Fish. Aquatic Sci.* 37(4):725-729. Apr. 1980. SFA 25(2)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-000875 Clarke, A. J. and D. M. Witcomb. A STUDY OF THE HISTOLOGY AND MORPHOLOGY OF THE DIGESTIVE TRACT OF THE COMMON EEL (*ANGUILLA ANGUILLA*). *J. Fish Biol.* 16(2):159-170. Feb. 1980. SFA 25(2)
[Biol. Dep., Univ. Salford, Salford M5 4WT, England]

80-000876 Cooke, I. R. C. and G. Campbell. THE VASCULAR ANATOMY OF THE GILLS OF THE SMOOTH TOADFISH *TORQUIGINER GLABER* (Teleostei: Tetraodontidae). *Zoomorphologie* 94(2):151-166. 1980. SFA 25(2)
[Dep. Zool., Univ. Melbourne, Parkville, Victoria, Australia]

80-000877 Cooke, I. R. C. FUNCTIONAL ASPECTS OF THE MORPHOLOGY AND VASCULAR ANATOMY OF THE GILLS OF THE ENDEAVOUR DOGFISH, *CENTROPHORUS SCALPRATUS* (McCulloch) (Elasmobranchii: Squalidae). *Zoomorphologie* 94(2):167-183. 1980. SFA 25(2)
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80-000879 Dorsa, W. J. and R. A. Fritzsche. CHARACTERS OF NEWLY HATCHED LARVAE OF *MORONE CHRYSOPS* [PISCES, PERCICHTHYIDAE], FROM YOCONA RIVER, MISSISSIPPI. *J. Miss. Acad. Sci.* 24:37-41. 1979. SFA 25(2)
[Dep. Biol., Univ. Miss., University 38677]

80-000880 Dutta, H. M. COMPARATIAVE ANALYSIS OF THE HYOMANDIBULA DURING RESPIRATION IN ANABANTOID TELEOST FISHES: *MACROPODUS OPERCULARIS* IN RELATION TO *CTENOPOMA ACUTIROSTRE* AND *ANABAS TESTUDINEUS*.

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80-000880 CONTINUED *Zoomorphologie* 94(2):185-202. 1980. SFA 25(2)
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[Fac. Agric., Alexandria, Egypt] Estimates of correlation from channel catfish (*Ictalurus punctatus*) sib-families reared in intensively stocked tanks showed that it is possible to predict the family influence in market body weight from body weight data taken as early as 4 weeks. Survival during the first 15 weeks was highly correlated with body weights or lengths from 4 to 12 weeks. Food conversion during the period 20 to 40 weeks was highly correlated with body weights between 16 and 56 weeks. Correlations between survival and food conversion ratio and, also, between 4 to 12 week body size traits and either 16 to 40 or 41 to 56 week survival were not significant.

80-000883 Emel'yanova, N. G. ULTRASTRUCTURE OF OOGONIA AND OOCYTES IN SILVER CARP. *Sov. J. Dev. Biol.(Engl. Transl. Ontogenez)* 10(2):126-132. Mar.-Apr. 1980. SFA 25(2)
[Dep. Ichthyol., Moscow Univ., USSR]

80-000884 Gilbert, P. W. STRUCTURE AND FUNCTION OF SHARK SIPHON SACS. *Fla. Sci.* 43(Suppl. 1):9. 1980. Abstract only. SFA 25(2)
[Div. Biol. Sci., Cornell Univ., Ithaca, NY 14853] With few exceptions (*Hexanchus griseus, Notorhynchus platycephalus,* and *Chlamydoselachus anguineus*) paired subcutaneous, muscular, epithelium-lined bladders, situated between the skin and belly musculature, known as siphon sacs appear in all species of male sharks thus far studied. The blind anterior end of each sac in mature orectolobid (*Hemiscyllium, Ginglymostoma*), carcharhinid (*Galeocerdo, Negaprion, Carcharhinus*) and triakid (*Mustela*) genera extends forward to the coracoid bar. Large goblet-like cells in the stratified epithelium lining the lumen of each sac secrete a clear viscous fluid which serves to lubricate the clasper. Each sac opens posteriorly, by an apopyle, into a clasper groove. Prior to copulation sea water is pumped into each siphon sac by repeated flexings of a clasper. After clasper insertion, sperm pass from the male urogenital papilla into the clasper groove and sea water expressed from the adjoining siphon sac washes the sperm up the oviduct.

80-000885 Grimm, H. VERÄNDERUNGEN IN DER VARIABILITÄT VON POPULATIONEN DES ZAHNKARPFENS *APHANIUS ANATOLIAE* (LEIDENFROST, 1912) WÄHREND 30 JAHREN: 1943-1974. [CHANGES IN THE VARIABILITY OBSERVED IN POPULATIONS OF THE CYPRINODONT *APHANIUS ANATOLIAE* OVER A PERIOD OF 30 YEARS: 1943-1974.] *Z. Zool. Syst. Evolutionsforsch.* 17(4):272-280. Dec. 1979. In German with English summ. SFA 25(2)
[Zool. Inst., Martin-Luther-King-Platz 3, D-2000 Hamburg 13, West Germany]

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80-000886 Hebrank, M. R. MECHANICAL PROPERTIES AND LOCOMOTOR FUNCTIONS OF EEL SKIN. *Biol. Bull. (Woods Hole)* 158(1):58-68. Feb. 1980. SFA 25(2)
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80-000887 Hirji, K. N. and W. A. M. Courtney. 'PEAR-SHAPED' CELLS IN THE DIGESTIVE TRACT OF THE PERCH *PERCA FLUVIATILIS* (L.). *J. Fish Biol.* 15(6):629-632. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Dar es Salaam, P.O. Box 35064, Dar es Salaam, Tanzania]

80-000888 Hueter, R. E. and S. H. Gruber. RECENT ADVANCES IN STUDIES OF THE VISUAL SYSTEM OF THE JUVENILE LEMON SHARK (*NEGAPRION BREVIROSTRIS*). *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Fla., Gainesville 32611] Due to its phyletic position among the selachians, its relative abundance in Florida coastal waters, and its uncommon adaptability to laboratory conditions, the juvenile lemon shark is an excellent model for studies of the sensory biology of the "typical" shark. My investigations of the physiological optics of this shark's eye have resulted in a mathematical model, or schematic eye, for the species. This optical model is centered around an ellipsoidal lens of high overall equivalent refractive index (1.664) and principal power (140 Diopters), and yet all data indicate these animals to be hypermetropic (far-sighted) by about 3 Diopters or more in seawater, with no evidence of accommodation. Using the schematic eye, optical limitations on spatial vision of this shark are predictable. In addition to discussing the optics, I will briefly review recent findings on the functional and anatomical organization of the retina, as well as psychophysical measurements of absolute sensitivity, of the juvenile lemon shark.

80-000889 Kanno, Y. [ON THE LIFE HISTORY OF HERRING, *CLUPEA PALLASII* CUVIER ET VALENCIENNES, IN THE BRACKISH LAKE NOTORO, HOKKAIDO. I. THE COMPOSITION OF BODY LENGTH, VERTEBRAL NUMBERS AND THE TIME OF RING FORMATION ON THE SCALES.] *Bull. Fac. Fish. Hokkaido Univ.* 30(4):259-271. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Biol. Fish Popul. Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-000890 Kavaliers, M.; B. T. Firth and C. L. Ralph. PINEAL CONTROL OF THE CIRCADIAN RHYTHM OF COLOUR CHANGE IN THE KILLIFISH (*FUNDULUS HETEROCLITUS*). *Can. J. Zool.* 58(3):456-460. Mar. 1980. In English with French summ. SFA 25(2)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] The killifish, *Fundulus heteroclitus*, displays a circadian rhythm of colour change (pigment aggregation and dispersion) under constant light and temperature conditions. Pinealectomy elimates the circadian rhythm of colour change but does not affect physiological colour change and background adaptation. Pineal control of the rhythm of colour change is interpreted as arising from the pineal's involvement in determining circadian organization.

80-000891 Kleckner, R. C. SWIMBLADDER WALL GUANINE ENHANCEMENT RELATED TO MIGRATORY DEPTH IN SILVER PHASE *ANGUILLA ROSTRATA*. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(3):351-354. 1980. SFA 25(2)
[Dep. Zool., Univ. Me., Orono 04469]

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[Dep. Gen. Anat., Gifer Coll. Dent., 1851 Takano, Hozumi-cho, Motosu-gun, Gifer Pref., Japan]

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[Karwar Res. Cent. C.M.F.R. Inst., Karwar, India]

80-000894 Lal Mohan, R. S. and V. Gandhi. RECORD OF PACIFIC PARROT FISH *YPSISCARUS OEDEMA* (SNYDER) FROM GULF OF MANNAR. *Indian J. Fish.* 23(1/2):241-243. 1976. SFA 25(2)
[Mandapam Reg. Cent. C.M.F.R. Inst., Mandapam Camp, India]

80-000895 Lane, E. B. and M. Whitear. SKEIN CELLS IN LAMPREY EPIDERMIS. *Can. J. Zool.* 58(3):450-455. Mar. 1980. In English with French summ. SFA 25(2)
[Dep. Zool., Univ. Coll. London, Gower St., London WCIE 6BT, England] The fine structure of the so-called club cells in lamprey skin shows that they are modified basal layer epidermal cells and therefore are not homologous with the club cells of teleost skin which are unicellular secretory elements. It is proposed that the cell type in lampreys be renamed "skein cell"; this term is indicative of the structure. It is noted that tonofilaments in bundles are united into a meshwork by apparent adhesion between individual filaments, so enhancing their efficiency as a cytoskeleton. The function of the skein cells may be to provide support against distortion in the soft mucigenic epidermis and to protect the germinative cells.

80-000896 Lauder, G. V., Jr. THE ROLE OF THE HYOID APPARATUS IN THE FEEDING MECHANISM OF THE COELACANTH *LATIMERIA CHALUMNAE*. *Copeia* 1980(1):1-9. 1 Feb. 1980. SFA 25(2)
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80-000897 Leino, R. L. THE EFFECTS OF PERIODIC ACID-SILVER METHENAMINE STAINING AND PROTEASE DIGESTION ON THE SECRETORY GRANULES OF RODLET CELLS. *Proc. Electron Microsc. Soc. Am.* 37:310-311. 1979. SFA 25(2)
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80-000898 Lesseps, R. J.; M. V. Lapeyre and M. V. Hall. TISSUE CULTURE EVIDENCE ON THE CONTROL OF THE SWITCH FROM CONTACT INHIBITION OF CELL MOVEMENT TO OVERLAPPING BEHAVIOR IN ANNUAL FISH EMBRYOS OF *NOTHOBRANCHIUS KORTHAUSAE*. *J. Exp. Zool.* 210(3):521-528. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Loyola Univ., New Orleans, LA 70118]

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[Zool. Inst., Univ. Hamburg, West Germany]

80-000901 Mikulin, A. Ye.; V. V. Gerasimchuk and V. N. Dubrovin. PIGMENTATION OF THE EGGS OF THE LUMPFISH, *CYCLOPTERUS LUMPUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):816-821. 1978. SFA 25(2)
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[Dep. Biol., Univ. South. Miss., Hattiesburg 39401]

80-000904 Morrison, C. M. A DENSE CELL IN THE EPITHELIUM OF THE GILL LAMELLAE OF THE BROOK TROUT, *SALVELINUS FONTINALIS* (MITCHELL). *J. Fish Biol.* 15(5):601-605. Nov. 1979. SFA 25(2)
[Fish. Mar. Serv., Halifax Lab., P.O. Box 550, Halifax, NS B3J 3S7, Canada] A cell was found in freshwater brook trout which was similar to a chloride cell as it was mitochondria-rich with an extensive tubular network, but differed in having a dark cytoplasm, large round vesicles in the apical cytoplasm, and large membrane-bound bodies near the nucleus. The base of the cell was separated from the basement membrane by cytoplasm from another epithelial cell. The cell was more rarely found in trout adapted to brackish water and salt water.

80-000905 Nelichik, V. A. MORPHOMETRIC FEATURES OF THE BURBOT, *LOTA LOTA*, OF THE UPPER TULOMA RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):756-764. 1978. SFA 25(2)
[PINRO, Murmansk, USSR] On the basis of research on the morphological characters of the burbot, *Lota lota*, it is shown that this species in the Upper Tuloma reservoir is represented by two ecological forms: the lake form and the lake-river form. The morphological variability of the burbot living in different waters is compared.

80-000906 Nicol, J. A. C. STUDIES ON THE EYES OF TOADFISHES *OPSANUS*. STRUCTURE AND REFLECTIVITY OF THE STRATUM ARGENTEUM. *Can. J. Zool.* 58(1):114-121. Jan. 1980. In English with French summ. SFA 25(2)
[Mar. Sci. Lab., Univ. Tex., Port Aransas 78373]

80-000907 Ovcharov, O. P. THE VARIABLE GEOMETRY OF THE CAUDAL FIN OF THE PORGY, *SPICARA SMARIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):863-866. 1978. SFA 25(2)
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[Sevastopol Dep., Yugrybpromrazvedki, USSR]

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[Cent. Adv. Stud. Mar. Biol., Annamalai Univ., Parangipettai 608 502, Tamil Nadu, India]

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[Dep. Anat., Queens's Univ., Kingston, ON K7L 3N6, Canada]

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[Lab. Anat. Comp., Mus. Natl. Hist. Nat., 55 rue de Buffon, 75005 Paris, France]

80-000913 Rubtsov, V. V. and Zh. A. Chernyaev. CHANGES IN THE ARCHITECTONICS OF BAIKAL OMUL *COREGONUS AUTUMNALIS MIGRATORIUS* EGGS DURING EMBRYOGENESIS. *Sov. J. Dev. Biol. (Engl. Transl. Ontogenez)* 10(3):258-262. Mar. 1980. SFA 25(2)
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80-000916 Santer, R. M. and M. G. Walker. MORPHOLOGICAL STUDIES ON THE VENTRICLE OF TELEOST AND ELASMOBRANCH HEARTS. *J. Zool. (Lond.)* 190(2):259-272. Feb. 1980. SFA 25(2)
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80-000919 Shelton, W. L. and R. R. Stephens. COMPARATIVE EMBRYOGENY AND EARLY DEVELOPMENT OF THREADFIN AND GIZZARD SHAD. *Prog. Fish-Cult.* 42(1):34-41. Jan. 1980. SFA 25(1)
[Ala. Coop. Fish. Res. Unit, Auburn Univ., Auburn 36830]

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[Moscow Univ., USSR]

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[Fla. Dep. Nat. Resour. Mar. Res. Lab., 100 Eighth Ave., S.E., St. Petersburg 33701]

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[Dep. Anat., Fac. Med., Univ. Singapore, Sepoy Lines, Singapore 3]

80-000924 van Hasselt, M. J. F. M. A KINEMATIC JAW MODEL FOR THE RAPID WIDE OPENING AND THE CLOSING OF THE MOUTH IN SOME LABRINAE (PISCES, PERCIFORMES). *Neth. J. Zool.* 29(3):352-401. Sept. 1979. SFA 25(2)
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[Zool Mus., State Univ. Moscow, USSR]

80-000926 Verigina, I. A. MICROSCOPIC STRUCTURE OF THE ALIMENTARY CANAL IN FISHES OF THE GENUS *ALEPOCEPHALUS* (SALMONIFORMES, ALEPOCEPHALIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):937-946. 1978. SFA 25(2)
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80-000927 Walker, M. G.; J. Horwood and L. Emerson. ON THE MORPHOLOGY AND FUNCTION OF RED AND WHITE SKELETAL MUSCLE IN THE ANCHOVIES *ENGRAULIS ENCRASICOLUS* L. AND *E. MORDAX* GIRARD. *J. Mar. Biol. Assoc. UK* 60(1):31-37. Feb. 1980. SFA 25(2)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, England]

80-000928 Waterworth, G. D. FUNCTIONAL MORPHOLOGY OF THE FEEDING MECHANISM OF THE SLENDER SNIPEFISH *MACRORHAMPHOSUS GRACILIS*. *M.A. thesis, Calif. State Univ. (Long Beach)* 66p. 1979. From Masters Abstr. 17(4):295. Dec. 1979. SFA 25(2)
The feeding mechanism of *Macrorhamphosus gracilis* is unique in having a hyoid locking mechanism to increase the speed of buccal cavity expansion. Function of this lock is dependent upon dorsal rotation of the head by specially modified epaxial muscles, and anterodorsal rotation of the hyoid arch by the protractor hyoidei muscle. The modifications of the anterior epaxial muscles include: 1) lack of myosepta; 2) parallel arrangement of the elongate fibers; 3) division into two bundles of fibers; and 4) lack of attachment to the vertebral column. Additional pertinent myological and osteological features of the feeding mechanism are presented and discussed.

80-000929 Webb, P. W. and J. M. Skadsen. REDUCED SKIN MASS: AN ADAPTATION FOR ACCELERATION IN SOME TELEOST FISHES. *Can. J. Zool.* 57(8):1570-1575. Aug. 1979. In English with French summ. SFA 25(2)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

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[Oreg. Coop. Fish. Res. Unit, Oreg. State Univ., Corvallis 97331]

80-000931 Zapata, A. SPLENIC ERYTHROPOIESIS AND THROMBOPOIESIS IN ELASMOBRANCHS: AN ULTRASTRUCTURAL STUDY. *Acta Zool. (Stockh.)* 61(1):59-64. 1980. SFA 25(2)
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80-000932 Žorić, L. M. and V. Žorić. THE ROLE OF THE SECRETORY NEUROCYTES IN THE REGULATION OF SEXUAL FUNCTION IN THE FISH *ASPRO ZINDEL* L. *Gen. Comp. Endocrinol.* 40(3):356. Mar. 1980. Abstract only. SFA 25(2)
[Inst. Biol., Med. Fac. Niš, 18000 Niš, Yugoslavia]

80-000933 Abraham, M.; E. Rehamim; H. Tibika and E. Golenser. THE BLOOD-TESTIS BARRIER IN TELEOSTS. *Gen. Comp. Endocrinol.* 40(3):318-319. Mar. 1980. Abstract only. SFA 25(2)
[Hebrew Univ. Jerusalem, Jerusalem, Israel]

80-000934 Abrahamsson, T.; S. Holmgren; S. Nilsson and K. Pettersson. ADRENERGIC AND CHOLINERGIC EFFECTS ON THE HEART, THE LUNG AND THE SPLEEN OF THE AFRICAN LUNGFISH, *PROTOPTERUS AETHIOPICUS*. *Acta Physiol. Scand.* 107:141-147. 1979. SFA 25(2)
[Dep. Zoophysiol., Univ. Göteborg, Sweden] Effects of adrenergic and cholinergic drugs were studied on isolated preparations from the heart, the

PHYSIOLOGY

80-000934 CONTINUED lung and the spleen of the African lungfish. In addition, a nerve-lung preparation was employed for the study of the autonomic nervous control of the lung. Falck-Hillarp fluorescent histochemistry was used in the search for adrenergic neurons in the sympathetic chain and tissues. The *Protopterus* lung received a cholinergic excitatory innervation via the pulmonary branches of the vagi. The presence of parasympathetic ganglia in the lung tissue is indicated. Adrenergic drugs, when producing a response, either contracted or relaxed lung strips. Spleen strips were contracted by cholinergic drugs acting on muscarinic receptors and, to a lesser extent, by adrenergic drugs. A strong negative inotropic effect was produced by carbachol on paced atrial but not ventricular strips, while adrenaline increased the contraction force in ventricular but not atrial strips. The sympathetic ganglion cells did not contain enough catecholamines to give off any visible fluorescence, nor was it possible to show any adrenergic nerve terminals in the tissues studied. It is concluded that the adrenergic control in the lungfish is mainly due to circulating catecholamines, rather than adrenergic nerve fibres, since concentrations of catecholamines in *Protopterus* plasma are high enough to affect the spleen, lung and ventricle.

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[Dep. Zoophysiol., Univ. Göteborg, Sweden]

80-000936 Abrahamsson, T.; A.-C. Jönsson and S. Nilsson. CATECHOLAMINE SYNTHESIS IN THE CHROMAFFIN TISSUE OF THE AFRICAN LUNGFISH, *PROTOPTERUS AETHIOPICUS*. *Acta Physiol. Scand.* 107(2):149-151. Oct. 1979. SFA 25(2)
[Dep. Zoophysiol., Univ. Göteborg, Sweden]

80-000937 Agius, C. THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH. *J. Fish Dis.* 2(4):337-343. July 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-000938 Akoev, G. N.; N. O. Volpe and G. G. Zhadan. ANALYSIS OF EFFECTS OF CHEMICAL AND THERMAL STIMULI ON THE AMPULLAE OF LORENZINI OF THE SKATES. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(2):193-201. 1980. SFA 25(2)
[Pavlov Inst. Physiol., Acad. Sci. USSR, Leningrad, USSR]

80-000939 Alexander, J. B. and G. A. Ingram. A COMPARISON OF FIVE OF THE METHODS COMMONLY USED TO MEASURE PROTEIN CONCENTRATIONS IN FISH SERA. *J. Fish Biol.* 16(2):115-122. Feb. 1980. SFA 25(2)
[Dep. Biol., Gardner St. Annexe, Univ. Salford, Salford M6 6WZ, England]

80-000940 Ash, R. HYDROLYTIC CAPACITY OF THE TROUT (*SALMO GAIRDNERI*) INTESTINAL MUCOSA WITH RESPECT TO THREE SPECIFIC DIPEPTIDES. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(1):173-176. 1980. SFA 25(2)
[Sch. Appl. Biol., Univ. Bradford, Bradford BD7 1DP, West Yorkshire, England]

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80-000941 Assem, H. and W. Hanke. CORTISOL LEVEL AND CELL VOLUME REGULATION PROCESSES IN *TILAPIA MOSSAMBICA*. *Gen. Comp. Endocrinol.* 40(3):344. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool. II, University, D 75 Karlsruhe 1, West Germany]

80-000942 Babiker, M. M. and J. C. Rankin. DIURETIC AND ANTIDIURETIC ACTIONS OF AVT AND ISOTOCIN IN THE TELEOST FISH *CLARIAS LAZERA*. *Gen. Comp. Endocrinol.* 40(3):337. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Khartoum, Sudan]

80-000943 Baker, B. I. and T. A. Rance. CIRCADIAN CHANGES IN PLASMA CORTISOL CONCENTRATIONS IN THE TROUT. *Gen. Comp. Endocrinol.* 40(3):344. Mar. 1980. Abstract only. SFA 25(2)
[Sch. Biol., Bath Univ., Bath, England]

80-000944 Bath, R. N. and F. B. Eddy. IONIC AND RESPIRATORY REGULATION IN RAINBOW TROUT DURING RAPID TRANSFER TO SEAWATER. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 134(4):351-357. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Univ. Dundee, Dundee DD1 4HN, Great Britain]

80-000945 Bath, R. N. and F. B. Eddy. SALT AND WATER BALANCE IN RAINBOW TROUT (*SALMO GAIRDNERI*) RAPIDLY TRANSFERRED FROM FRESH WATER TO SEA WATER. *J. Exp. Biol.* 83:193-202. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Univ. Dundee, Dundee DD1 4HN, Scotland] Physiological responses of rainbow trout (mean weight 13.3 g) to sudden changes in salinity were investigated. An initial period lasting about 8 h was characterized by increased drinking and an increase in plasma and body ions. Fish failed to survive more than 2 days in full strength sea water but in two-thirds sea water there were few mortalities and adaptation was complete in 7-10 days. During this period there were gradual physiological changes resulting in normal plasma ion concentrations but significantly increased body ionic content. The intracellular concentrations of muscle chloride showed the greatest increase.

80-000946 Batty, R. S. and C. S. Wardle. RESTORATION OF GLYCOGEN FROM LACTIC ACID IN THE ANAEROBIC SWIMMING MUSCLE OF PLAICE, *PLEURONECTES PLATESSA* L. *J. Fish Biol.* 15(5):509-519. Nov. 1979. SFA 25(2)
[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland]

80-000947 Benjamin, M. THE RESPONSE OF PROLACTIN, ACTH, AND GROWTH HORMONE CELLS IN THE PTIUITARY GLAND OF THE THREE-SPINED STICKLEBACK, *GASTEROSTEUS ACULEATUS* L. FORM *LEIURUS*, TO INCREASED ENVIRONMENTAL SALINITIES. *Acta Zool. (Stockh.)* 61(1):1-7. 1980. SFA 25(2)
[Dep. Anat., Univ. Coll., Cardiff, Wales]

80-000948 BIOLOGY OF THE CHLORIDE CELL: JEAN MAETZ MEMORIAL SYMPOSIUM. *Am. J. Physiol.* 238(3):R139-R276. Mar. 1980. SFA 25(2)
A collection of papers.--RS

80-000949 Booth, J. H. THE EFFECTS OF OXYGEN SUPPLY, EPINENPHRINE, AND ACETYLCHOLINE ON THE DISTRIBUTION OF BLOOD FLOW IN TROUT GILLS. *J. Exp. Biol.* 83:31-39. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Toronto, Toronto, ON M5S 1A1, Canada]

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80-000950 Borg, B. and P. Ekström. GONADAL EFFECTS OF MELATONIN IN THE THREE-SPINED STICKLEBACK, *GASTEROSTEUS ACULEATUS*. *Gen. Comp. Endocrinol.* 40(3):366. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Lund, Lund, Sweden]

80-000951 Bouck, G. R. CONCENTRATIONS OF LEUCINE AMINONAPHTHYLAMIDASE (LAN) AND SOLUBLE PROTEIN IN TISSUES OF RAINBOW TROUT, *SALMO GAIRDNERI*. *Can. J. Fish. Aquatic Sci.* 37(1):116-120. Jan. 1980. In English with French summ. SFA 25(2)
[Natl. Fish. Res. Cent., Bldg. 204, Naval Support Act., Seattle, WA 98115]

80-000952 Breepoel, P. M.; F. Kreuzer and M. Hazevoet. STUDIES OF THE HEMOGLOBINS OF THE EEL (*ANGUILLA ANGUILLA* L.)--I. PROTON BINDING OF STRIPPED HEMOLYSATE; SEPARATION AND PROPERTIES OF TWO MAJOR COMPONENTS. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):69-75. 1980. SFA 25(2)
[Dep. Physiol., Fac. Med., Catholic Univ., Nijmegen, The Netherlands]

80-000953 Brill, R. W. and A. E. Dizon. RED AND WHITE MUSCLE FIBRE ACTIVITY IN SWIMMING SKIPJACK TUNA, *KATSUWONUS PELAMIS* (L.). *J. Fish Biol.* 15(6):679-685. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. British Columbia, 2075 Wesbrook Mall, Vancouver, BC V6T 1W5, Canada] To test the hypothesis that white muscle fibre portions of the myotomes are used at sustainable swimming speeds, skipjack tuna, *Katsuwonus pelamis*, were forced to swim against various current velocities in a water tunnel while electrical activity of the red and white muscle fibres was simultaneously recorded. Eight fish were tested, five fish graded white muscle fibres into activity at swimming speeds above their minimum hydrostatic equilibrium speed, but well below the estimated maximum sustainable swimming speed of skipjack tuna. Three other fish showed white muscle fibre activity at minimum swimming speeds, a possibly abnormal condition.

80-000954 Brooke, L. T. and P. J. Colby. DEVELOPMENT AND SURVIVAL OF EMBRYOS OF LAKE HERRING AT DIFFERENT CONSTANT OXYGEN CONCENTRATIONS AND TEMPERATURES. *Prog. Fish-Cult.* 42(1):3-9. Jan. 1980. SFA 25(2)
[U.S. FWS, Great Lakes Fish. Lab., Ann Arbor, MI 48105]

80-000955 Buckley, L. J. CHANGES IN RIBONUCLEIC ACID, DEOXYRIBONUCLEIC ACID, AND PROTEIN CONTENT DURING ONTOGENESIS IN WINTER FLOUNDER, *PSEUDOPLEURONECTES AMERICANUS*, AND EFFECT OF STARVATION. *NOAA Fish. Bull.* 77(3):703-708. July 1979. SFA 25(2)
[NMFS, RR 7A, Box 522 A, Narragansett, RI 02882]

80-000956 Bullock, T. H. WHAT IS THE INTEREST FOR GENERAL NEUROPHYSIOLOGY OF ELECTRORECEPTION IN CERTAIN FISHES? *J. Physiol. (Paris)* 75:315-317. 1979. SFA 25(2)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093]

80-000957 Burlakov, A. B. THE INFLUENCE OF PITUITARY INJECTIONS ON THE ACTIVITY AND ISOENZYME COMPOSITION OF MALATE DEHYDROGENASE IN SOME TISSUES OF THE FEMALE SILVER CARP, *HYPOPHTHALMICHTHYS MOLITRIX*. *J. Ichthyol. (Engl.*

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80-000957 CONTINUED *Transl. Vopr. Ikhtiol.)* 18(6):987-994. 1978. SFA 25(2)
[Biol. Fac., Moscow Univ., USSR]

80-000958 Burton, D. T. VENTILATION FREQUENCY COMPENSATION RESPONSES OF THREE EURYTHERMAL ESTUARINE FISH EXPOSED TO MODERATE TEMPERATURE INCREASES. *J. Fish Biol.* 15(5):589-600. Nov. 1979. SFA 25(2)
[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612] Ventilation frequency patterns of *Trinectes maculatus*, *Morone americana* and *Leiostomus xanthurus* were used to evaluate potential thermal stress after exposure to moderate temperature increases. Fish acclimated to 5°, 15° and 25°C were exposed to 5°CΔT; fish acclimated to 30°C were exposed to a 2.5°CΔT. Ventilation frequencies were measured at each acclimation temperature before the fishes were exposed over a 15-min period to the increased temperatures. Ventilation rates were then measured at the elevated temperatures for the next 24 h. Significant increases in rate frequency occurred after the temperature increases in *T. maculatus* and *M. americana* acclimated to 5°, 15°, 25°C and in *L. xanthurus* acclimated to 15°, 25° and 30°C. In general, rate frequencies increased as the temperature increased. Ventilation rates stabilized quickly at the higher temperatures and remained relatively constant throughout the remaining exposure period. Acclimated rate-temperature curves (R-T curves), acute R-T curves and Q_{10} temperature coefficients used to assess the significance of the changes in rate frequency and to compare the species in an ecologically meaningful way, showed that several adaptive types occurred among and between species. The Q_{10}'s of the acute R-T curves, in most cases, were found to approximate those values derived for the acclimated R-T curve. This suggests that the temperature increases had a negligible effect, that is, little or no thermal stress occurred.

80-000959 Burton, D. T.; P. R. Abell and T. P. Capizzi. COLD SHOCK: EFFECT OF RATE OF THERMAL DECREASE ON ATLANTIC MENHADEN. *Mar. Pollut. Bull.* 10(12):347-349. Dec. 1979. SFA 25(2)
[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612] This study was designed to assess the effects of various rates of thermal decrease on mortality of juvenile Atlantic menhaden (*Brevoortia tyrannus*) which may result from winter shutdown of large power plant facilities. Temperatures were lowered from 15 to 5°C at rates of decrease which ranged from 27.0 to 0.4°C/h. A significant correlation was found between rate of thermal decrease and mortality. The relationship between percent mortality and rate of decrease was best described by a piecewise regression curve with two rates; one rate where mortality was high and a second where mortality decreased rapidly as the rate of temperature reduction decreased.

80-000960 Burzawa-Gerard, E. and S. Dufour. CARP GONADOTROPIN α AND β SUBUNITS: THE SPECIFICITY OF THEIR ANTIGENIC DETERMINANTS. *Gen. Comp. Endocrinol.* 40(3):337-338. Mar. 1980. Abstract only. SFA 25(2)
[Lab. Physiol., CNRS Mus., Paris, France]

80-000961 Chaves, J. M.; M. Carrillo; H. Duve; A. Thorpe and J. Planas. PLASMA INSULIN MEASUREMENTS IN MEDITERRANEAN FISHES DETERMINED BY RADIOIMMUNOASSAY. *Gen. Comp. Endocrinol.* 40(3):350. Mar. 1980. Abstract only. SFA 25(2)
[Fisiol. Dep., Fac. Biol., Univ. Barcelona, Spain]

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80-000962 Cimini, V. and A. Cecio. ON THE OCCURRENCE OF ENDOCRINE CELLS WITHIN THE PYLORIC MUCOSA OF *SCYLIORHINUS CANICULA*. PRELIMINARY ULTRASTRUCTURAL OBSERVATIONS. *Gen. Comp. Endocrinol.* 40(3):350. Mar. 1980. Abstract only. SFA 25(2)
[Inst. Human Anat., II Fac. Med., Naples, Italy]

80-000963 Coates, M.; J. Thompson and M. E. Tate. ISOLATION OF O-PHOSPHORYLETHANOLAMINE FROM THE ERYTHROCYTES OF AN ELASMOBRANCH (THE SOUTHERN FIDDLER RAY--*TRYGONORHINA FASCIATA GUANERIUS*). *J. Exp. Zool.* 210(3):489-496. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Adelaide, Adelaide, South Australia 5000]

80-000964 Crim, L. W. and D. M. Evans. LH--RH-STIMULATED GONADOTROPIN RELEASE FROM THE RAINBOW TROUT PITUITARY GLAND: AN *IN VITRO* ASSAY FOR DETECTION OF TELEOST GONADOTROPIN RELEASING FACTOR(S). *Gen. Comp. Endocrinol.* 40(3):283-290. Mar. 1980. SFA 25(2)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-000965 Daye, P. G. and E. T. Garside. DEVELOPMENT, SURVIVAL, AND STRUCTURAL ALTERATIONS OF EMBRYOS AND ALEVINS OF ATLANTIC SALMON, *SALMO SALAR* L., CONTINUOUSLY EXPOSED TO ALKALINE LEVELS OF pH, FROM FERTILIZATION. *Can. J. Zool.* 58(3):369-377. Mar. 1980. In English with French summ. SFA 25(2)
[Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Embryos of the Atlantic salmon, *Salmo salar* L., were incubated continuously from fertilization at pH 6.8 (control) and pH 9.0 and 9.5, initially at 6.7°C but with a gradual decline in the first 5 weeks to 5.0°C for the remaining 10 weeks of exposure. Subsequently, the alevins were maintained in these environments for 50 days after hatching. Developmental processes and hatching were not affected by these levels of pH. Percentage cumulative mortality of treated embryos, 8%, was approximately that in the controls. Alevin mortality in the control lots was 1.2 and 1.3%. At pH 9.0, cumulative mortality was 0.4%, but at pH 9.5 there was an accelerating increase to 18%, at the termination of observation. Sublethal changes in embryos were confined mostly to cell necrosis and sloughed rudimentary epidermis. Some metaplasia of the brain stem occurred at pH 9.5. Sites and intensity of alterations increased in alevins at pH 9.5, following the loss of the zona radiata. In addition to ongoing injury of epidermis, including mucous cells, deleterious alterations occurred in brachial epithelium, erythrocytes, myocardium, blood vessels of the viscera, liver, brain, and optic lenses. In general, sublethal changes caused by hydroxyl ions are similar to those caused by excessive hydrogen ions but are somewhat less extensive in the structures affected or in their degree of severity.

80-000966 de Ruiter, A. J. H. CHANGES IN GLOMERULAR STRUCTURE AFTER SEXUAL MATURATION AND SEAWATER ADAPTATION IN MALES OF THE EURYHALINE TELEOST *GASTEROSTEUS ACULEATUS* L. *Cell Tissue Res.* 206(1):1-20. Feb. 1980. SFA 25(2)
[Dep. Zool., State Univ. Groningen, P.O. Box 14, 9750 AA Haren, The Netherlands]

80-000967 de Vlaming, V. EFFECTS OF PINEALECTOMY AND MELATONIN TREATMENT ON GROWTH IN THE GOLDFISH, *CARASSIUS AURATUS*. *Gen. Comp. Endocrinol.* 40(2):245-250. Feb. 1980. SFA 25(2)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

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80-000968 Delahunty, G. and V. L. de Vlaming. SEASONAL RELATIONSHIPS OF OVARY WEIGHT, LIVER WEIGHT AND FAT STORES WITH BODY WEIGHT IN THE GOLDFISH, *CARASSIUS AURATUS*. *J. Fish Biol.* 16(1):5-13. Jan. 1980. SFA 25(2)
[V. L. de Vlaming: Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-000969 Delahunty, G. B. ENVIRONMENTAL EFFECTS ON THE METABOLISM OF *CARASSIUS AURATUS*: ROLE OF THE PINEAL ORGAN AND RETINAL PATHWAYS. *Ph.D. dissertation, Marquette Univ.* 139p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4082. Mar. 1980. SFA 25(2)

80-000970 Delahunty, G.; C. B. Schreck and V. L. de Vlaming. EFFECTS OF PHOTOPERIOD ON PLASMA CORTICOID LEVELS IN THE GOLDFISH, *CARASSIUS AURATUS*--ROLE OF THE PINEAL. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(3):355-358. 1980. SFA 25(2)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-000971 Dodd, J. M.; M. H. I. Dodd and N. Jenkins. PRESENCE OF GONADOTROPHIN IN THE RACHENDACHHYPOPHYSE OF THE PITUITARY GLAND OF THE RABBIT FISH *HYDROLAGUS COLLIEI* (CHONDRICHTHYES: HOLOCEPHALI). *Gen. Comp. Endocrinol.* 40(3):342-343. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Coll. North Wales, Bangor, Gwynedd, Wales]

80-000972 Dunant, Y.; L. Eder and L. Servetiadis-Hirt. ACETYLCHOLINE RELEASE EVOKED BY SINGLE OR A FEW NERVE IMPULSES IN THE ELECTRIC ORGAN OF *TORPEDO*. *J. Physiol. (Lond.)* 298:185-203. Jan. 1980. SFA 25(2)
[Dep. Pharmacol., Ecol. Med., 20, 1211 Genève 4, Switzerland]

80-000973 Eddy, F. B. and R. N. Bath. IONIC REGULATION IN RAINBOW TROUT (*SALMO GAIRDNERI*) ADAPTED TO FRESH WATER AND DILUTE SEA WATER. *J. Exp. Biol.* 83:181-192. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Univ. Dundee, Dundee, DD1 4HN, Scotland] Small rainbow trout (5-20 g) adapt to salinities of up to at least 22°/oo but not to full strength sea water. In adapted fish plasma ions are regulated near the fresh water values, but there is an ionic invasion of the tissues, particularly by Cl^- in muscle cells. Analysis of ionic regulation in adapted fish indicates that balance is maintained mainly by expending energy on Cl^- regulation. Fish in full strength sea water can no longer regulate Na^+ or Cl^- in plasma or tissues, which results in high tissue concentrations of these ions and eventual death.

80-000974 Eddy, F. B.; G. R. Smart and R. N. Bath. IONIC CONTENT OF MUSCLE AND URINE IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON KEPT IN WATER OF HIGH CO_2 CONTENT. *J. Fish Dis.* 2(2):105-110. Mar. 1979. SFA 25(2)
[F. B. Eddy: Dep. Biol. Sci., Univ. Dundee, Dundee DD1 4HN, Scotland]

80-000975 Epler, P; E. Marosz and K. Bieniarz. EFFECT OF TELEOST PITUITARY GONADOTROPINS ON THE IN VITRO MATURATION OF CARP OOCYTES. *Aquaculture* 18(4):379-382. Dec. 1979. SFA 25(2)
[Inst. Appl. Zool., Acad. Agric., Krakow, Poland] Studies were conducted on the effects of various kinds of teleost pituitary gonadotropin on the in vitro maturation of carp oocytes. It was ascertained that after 24 h of

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80-000975 CONTINUED incubation with gonadotropins, the highest percentage of oocytes with the nucleus in the migrating or peripheral position, or of mature oocytes, was observed in the case of ciprinide gonadotropins. Centrifuged hypophysial homogenates of the pike, sea-trout and pike-perch displayed a considerably weaker activity. The results obtained are indicative of a specificity of teleost pituitary gonadotropins.

80-000976 Epple, A. and J. J. Kocsis. THE EFFECTS OF PANCREATECTOMY ON TISSUE TAURINE OF THE AMERICAN EEL UNDER VARYING OSMOTIC AND NUTRITIONAL CONDITIONS. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):139-142. 1980. SFA 25(2)
[Jefferson Med. Coll., Thomas Jefferson Univ., Philadelphia, PA 19107]

80-000977 Eveloff, J.; M. Field; R. Kinne and H. Murer. SODIUM-COTRANSPORT SYSTEMS IN INTESTINE AND KIDNEY OF THE WINTER FLOUNDER. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 135(2):175-182. 1980. SFA 25(2)
[Albert Einstein Coll. Med., Dep. Physiol., 1300 Morris Park Ave., Bronx, NY 10461]

80-000978 Ewing, R. D.; H. J. Pribble; S. L. Johnson; C. A. Fustish; J. Diamond and J. A. Lichatowich. INFLUENCE OF SIZE, GROWTH RATE, AND PHOTOPERIOD ON CYCLIC CHANGES IN GILL (Na + K)-ATPase ACTIVITY IN CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*). *Can. J. Fish. Aquatic Sci.* 37(4):600-605. Apr. 1980. SFA 25(2)
[Oreg. Dep. Fish Wildl., 303 Extension Hall, Oreg. State Univ., Corvallis 97331]

80-000979 Febinger, D. L. OVERWINTERING AND ENERGY SOURCES FOR FISHES IN A COLORADO MOUNTAIN STREAM. *J. Colo.-Wyo. Acad. Sci.* 12(1):16. Apr. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Colo., Boulder] Studies of fishes under winter conditions in a front range mountain stream are being conducted to better understand the effects of cold temperatures and ice on population structure and individual physiological adjustments to these environmental factors. Two sections of Left-Hand Creek, Boulder County are being investigated: an unstocked third order section, 7 km. east of Ward, elevation 2400 m., which supports a large population of brook trout, *Salvelinus fontinalis* (3900 ind./surf. ha.) and a lower, fourth order section, elevation 1900 m., with small late-autumn populations of stocked rainbow trout *Salmo gairdneri* (43 ind./surf. ha.), resident rainbows and longnose suckers, *Catostomus catostomus* (86 ind./surf. ha.). Late-fall brook trout populations were made up of many small, non-feeding individuals in relatively poor condition (CF=1.01), with low fat reserves whereas rainbows were actively feeding, in good condition (CF=1.40) with much visceral fat. Mean condition factor for rainbows through February did not change while for brooks it showed a slight downward trend and for suckers, which also were feeding, a change from 1.24 (Oct.) to 1.09 (Feb.). Rainbows had a higher fat/dry weight ratio (0.25) than did brooks and suckers (0.10) but no significant changes in this parameter have been observed for any species through February. Data on condition factors and body composition will be collected through early May along with spring population information to give a more complete picture of overall effects of a winter season.

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80-000980 Fields, R. D. and G. D. Lange. ELECTRORECEPTION IN THE RATFISH (*HYDROLAGUS COLLIEI*). *Science* 207(4430):547-548. 1 Feb. 1980. SFA 25(2)
[Mar. Neurobiol. Unit, A-001, Scripps Inst. Oceanogr., La Jolla, CA 92093] Behavioral and neurophysiological experiments and anatomical work indicate that the ampullar structures on the head of fish of the subclass Holocephali are sense organs responsive to weak electric fields and are functionally and structurally homologous to the ampullae of Lorenzini in elasmobranchs. It is concluded that, as in elasmobranchs, these organs are used to detect bioelectric and other natural electric phenomena in the environment.

80-000981 Follenius, E. and M. P. Dubois. ANTI-α-ENDORPHIN- AND ANTI-MET-ENKEPHALIN-POSITIVE PATHWAYS IN THE BRAIN AND PITUITARY OF CARP. *Gen. Comp. Endocrinol.* 40(3):353. Mar. 1980. Abstract only. SFA 25(2)
[Lab. Cytol. Anim., ERA 492 CNRS ULP Strasbourg, France]

80-000982 Folmar, L. C. SOME PHYSIOLOGICAL CHANGES IN COHO SALMON [*ONCORHYNCHUS KISUTCH*] DURING SMOLTIFICATION AND SEAWATER ADAPTATION. *Ph.D. dissertation, Univ. Wash.* 163p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4048. Mar. 1980. SFA 25(2)

80-000983 Ford, D. S. and R. W. Gauldie. BLOOD GROUP ANTIGEN/ANTIBODY REACTIONS OF SOME NEW ZEALAND FISHES. *N.Z. J. Mar. Freshwater Res.* 13(2):273-276. 1979. SFA 25(2)
[R. W. Gauldie: Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19-062, Wellington, New Zealand] The frequency of red blood cell antigens in the spiny dogfish, *Squalus acanthias*, was shown to be not statistically different from that described for fish from the Gulf of Maine, U.S.A. Five other species of fish in New Zealand waters, snapper (*Chrysophyrs auratus*), barracouta (*Thyrsites atum*), gurnard (*Trigla kumu*), red cod (*Pseudophycis bacchus*), and tarakihi (*Cheilodactylus macropterus*) were shown to carry antibodies that may be useful reagents in defining stocks of fish on the basis of red blood cell antigen frequency.

80-000984 Foucher, R. P. and R. J. Beamish. PRODUCTION OF NONVIABLE OOCYTES BY PACIFIC HAKE (*MERLUCCIUS PRODUCTUS*). *Can. J. Fish. Aquatic Sci.* 37(1):41-48. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-000985 Fouda, M. M. STUDIES ON SCALE REGENERATION IN THE COMMON GOBY, *POMATOSCHISTUS MICROPS* (PISCES). *J. Zool. (Lond.)* 189(4):503-522. Dec. 1979. SFA 25(2)
[Dep. Zool., Fac. Sci., Al-Azhar Univ., Cairo, Egypt]

80-000986 Foulley, M.-M. and J. Mellinger. LA DIFFUSION DE L'EAU TRITÉE, DE L'URÉE-^{14}C ET D'AUTRES SUBSTANCES À TRAVERS LA COQUE DE L'OEUF DE ROUSSETTE, *SCYLIORHINUS CANICULA*. [DIFFUSION OF TRITIATED WATER, ^{14}C-UREA AND OTHER COMPOUNDS ACROSS THE EGG SHELL OF THE SMALL SPOTTED DOGFISH, *SCYLIORHINUS CANICULA*.] *C. R. Hebd. Séances Acad. Sci. Sér. D Sci. Nat.* 290(5):427-430. 4 Feb. 1980. In French with English summ. SFA 25(2)
[Univ. Reims, Lab. Biol. Anim., Fac. Sci., 51100 Reims, France]

80-000987 Freadman, M. A. SWIMMING ENERGETICS OF STRIPED BASS (*MORONE SAXATILIS*) AND BLUEFISH (*POMATOMUS SALTATRIX*): GILL VENTILATION AND SWIMMING METABOLISM. *J. Exp. Biol.* 83:217-230. Dec. 1979. SFA 25(2)
[John B. Pierce Found., Yale Univ., 290 Congress Ave., New Haven, CT 06519]

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80-000988 Fryer, J. N. and H. A. Bern. GROWTH HORMONE BINDING TO TISSUES OF NORMAL AND STUNTED JUVENILE COHO SALMON, *ONCORHYNCHUS KISUTCH*. *J. Fish Biol.* 15(5):527-533. Nov. 1979. SFA 25(2)

[Dep. Anat., Fac. Med., Univ. Ottawa, Ottawa, ON K1N 9A9, Canada] The premature transfer of juvenile Coho salmon into seawater results in high mortality and a reduction of growth (stunting) of a significant portion of the population while the remainder of the salmon continue to grow normally. Binding studies were conducted with ^{125}I-labelled tilapia (*Sarotherodon mossambicus*) growth hormone (tGH) to determine if differences in specific binding of tGH existed in membrane preparations of tissues of stunted and normal coho salmon. Membrane preparations of both liver and gill of stunted salmon obtained from stocks in California, Washington and British Columbia and kidney membrane preparations obtained from stunted salmon in California exhibited deficiencies in ^{125}I-labelled tGH-binding sites compared to corresponding membrane preparations of normal smolt. These results indicate that stunted coho salmon have a decreased ability to bind GH which may be reflected in perturbations in GH-mediated processes.

80-000989 Gemelli, L.; G. Martino and B. Tota. OXIDATION OF LACTATE IN THE COMPACT AND SPONGY MYOCARDIUM OF TUNA FISH (*THUNNUS THYNNUS THYNNUS* L.). *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):321-326. 1980. SFA 25(2)

[B. Tota: Stoz. Zool., Villa Communale, 80121, Napoli, Italy]

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[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada] The oxygen equilibria of the multiple hemoglobin of the fry and adult life stages of coho salmon (*Oncorhynchus kisutch*) were investigated. Components A6-8 comprise 50-55% and >95% of the total hemoglobins of coho adults and fry respectively. Fry hemoglobins exhibited a high oxygen affinity (P_{50} = 3.9 mm Hg at 9.8°C, pH 8.5, a very large Bohr shift ($\phi = \Delta \log P_{50}/\Delta pH$ = -1.729 at pH 7.1-7.5) which was non-linear in the pH range 6.8-8.5 and a large heat of oxygenation (ΔH = -20.8 kcal/mol). Adult hemoglobins, however, exhibited a moderate oxygen affinity (P_{50} = 14.0 mm Hg at 9.8°C, pH 8.2), a very small linear Bohr shift (ϕ = -0.172 at pH 7.0 - 8.2) and a low heat of oxygenation (ΔH = -5.6 - -7.5 kcal/mol). Adenosine triphosphate had only minor influence on the oxygenation characteristics of adult heolyzates. The results are discussed in terms of function adaptation to environmental stresses and metabolic requirements.

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[B. Tota: Stazione Ecol., Villa Comunale, I-80121 Napoli, Italy] The myoglobin content in the hearts of several fishes is positively correlated with the ecological physiology of the species. In the tuna heart, where the highest myoglobin values are found, the logarithmic relationship between myoblobin content and body weight is reported.

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[TVA, Off. Nat. Resour., Water Qual. Ecol. Br., Muscle Shoals, AL 35630] Results from this study indicate that a fish density stress syndrome exists for red blood cell morphology. Smaller (by 3.5%) and rounder (by 0.6%) red blood cells were consistently found in intensive fish cultures.

80-001043 Nakahara, M.; S. Hirano; T. Ishii and T. Koyanagi. ACCUMULATION AND EXCRETION OF COBALT-60 TAKEN UP FROM SEAWATER BY MARINE FISHES. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1423-1428. Nov. 1979. SFA 25(2)
[Div. Mar. Radioecol., Natl. Inst. Radioecol. Sci., 3609, Isozaki, Nakaminato, Ibaraki 311-12, Japan] The accumulation and excretion of ^{60}Co taken up from seawater were observed using marine fishes to examine the radioactive pollution of marine organisms. Blood, internal medium was a good reserving pool of the nuclide in the fishes and it accumulated more than 15% of the radioactivity in the whole body of the fishes reared for about 90 days in the uptake experiment. Only liver and kidney showed higher radioactivity per unit weight than blood, in the tissues and organs, and muscle showed the lowest concentration of the nuclide. The biological half-lives in muscle of sea bream, yellowtail and flounder at 15°C were calculated as 38.5, 53.3 and 63.0 days, respectively. The steady state concentration factors of muscle by direct uptake of ^{60}Co from seawater were estimated in the range from 0.3 to 1.5 among the fishes in the experiments.

80-001044 Nevenzel, J. C. and N. K. Menon. LIPIDS OF MIDWATER MARINE FISH: FAMILY GONOSTOMATIDAE. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):351-355. 1980. SFA 25(2)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093]

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80-001045 Nishi, K. and K. Takano. [EFFECTS OF PHOTOPERIOD AND TEMPERATURE ON THE OVARY OF THE BITTERLING, *RHODEUS OCELLATUS OCELLATUS*]. *Bull. Fac. Fish. Hokkaido Univ.* 30(1):63-73. Feb. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-001046 Nishioka, F. and Y. Shimizu. [COAGULATION PROPERTIES OF FISH SARCOPLASMIC PROTEIN.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1557-1561. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish Post-Harvest Technol., Fac. Agric., Kochi Univ., Monobe, Nankoku-shi, Kochi-Ken 783, Japan]

80-001047 Nishioka, R. S. HYPOPHYSECTOMY OF TILAPIA (*SAROTHERODON MOSSAMBICUS*) THROUGH THE ORBIT. *Gen. Comp. Endocrinol.* 40(3):377-378. Mar. 1980. SFA 25(2)
[Dep. Zool. Cancer Res. Lab., Univ. Calif., Berkeley, 94720]

80-001048 Nishioka, R. S.; H. A. Bern and R. L. Gunther. HORMONE-CARRIER-NEUROSECRETORY GRANULE ASSOCIATION IN THE UROPHYSIS OF THE GOBY *GILLICHTHYS MIRABILIS*. *Acta Zool. (Stockh.)* 61(1):29-38. 1980. SFA 25(2)
[Dep. Zool., Univ. Calif., Berkeley]

80-001049 Olson, K. R. THE LINEAR CABLE THEORY AS A MODEL OF GILL BLOOD FLOW. *J. Theor. Biol.* 81(3):377-388. 7 Dec. 1979. SFA 25(2)
[Indiana Univ. Sch. Med., South Bend Cent., Univ. Notre Dame, Notre Dame 46556]

80-001050 Oppenheimer, J. M. FIFTY YEARS OF *FUNDULUS*. *Q. Rev. Biol.* 54(4):385-395. Dec. 1979. SFA 25(2)
[Biol. Lab., Bryn Mawr Coll., Bryn Mawr, PA 19010] Selected earlier contributions by the author concerning the development of *Fundulus* are reviewed. These concerned the normal development of the egg, and vital staining and transplantation experiments. The transplantations involved grafting of portions of the shield or the germ ring either to the shield or yolk-sac epithelium of gastrulae the same age as the donors. Grafting of portions of the germ ring to the yolk-sac epithelium led generally to negative results. Grafting portions of either germ ring or shield into the shield itself led to the differentiation in the hosts of many supernumerary structures, which were frequently surprisingly well organized. This was true also for grafts of shield material implanted onto the yolk-sac epithelium, even after they had been minced or otherwise fragmented. The results indicate that the *Fundulus* gastrula has considerable ability to regulate. Study of the behavior of hatchlings, reported in the 1950's, suggested that the central nervous system also has considerable powers of regulation, since when the brain contained accessory parts and was larger than normal, the functional behavior of the hatchlings was less disturbed than might have been expected. New results presented here for the first time report the study of hosts, carrying brain grafts, that were allowed to develop to adult stages. Of 21 specimens into which shield grafts had been implanted at gastrula stages, and which had been allowed to develop to the adult stage, 5 maintained braingrafts of appreciable size attached to or forming part of the primary brain.

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80-001051 Osuga, D. T.; R. E. Feeney; Y. Yeh and C.-L. Hew. CO-FUNCTIONAL ACTIVITIES OF TWO DIFFERENT ANTIFREEZE PROTEINS: THE ANTIFREEZE GLYCOPROTEIN FROM POLAR FISH AND THE NONGLYCOPROTEIN FROM A NEWFOUNDLAND FISH. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):403-406. 1980. SFA 25(2)

[Dep. Food Sci. Technol., Univ. Calif., Davis 95616] Two very different antifreeze proteins have been found in fish from ice-seawater environments, both of which function noncolligatively to lower the freezing temperature but not the melting point. One is a glycoprotein obtained from the polar fish *Trematomus borchgrevinki* and *Boreogadus saida*. The other is a nonglycoprotein obtained from the northern Atlantic Ocean fish *Pseudopleuronectes americanus* (winter flounder). Alanine constitutes approx 2/3 of the total amino acids in both proteins. When the glycoprotein and nonglycoprotein were tested individually or as mixtures, they gave similar performance curves.

80-001052 Perrier, H.; H. Bornet; C. Perrier and G. Pérès. INFLUENCE DE L'ACCLIMATATION DE LA TRUITE ARC-EN-CIEL (*SALMO GAIRDNERII* RICH.) À 9 ET 21°, AU COURS DE L'HIVER ET DU PRINTEMPS SUR LES TAUX PLASMATIQUES DES HORMONES THYRÏDIENNES ET DE LA PROTÉINE DE LIASON DES IODURES. [THYROID HORMONE AND IODIDE BINDING PROTEIN PLASMA LEVELS IN THE RAINBOW TROUT ACCLIMATED AT 9 AND 21° DURING WINTER AND SPRING]. *C.R. Hebd. Séances Acad. Sci. Sér. D Sci. Nat.* 289(4):429-431. 17 Sept. 1979. In French with English summ. SFA 25(2)

[Univ. Claude-Bernard, Lab. Pharm. Biochim., 69373 Lyon Cedex 2, France]

80-001053 Pettit, M. J. and T. L. Beitinger. THERMAL RESPONSES OF THE SOUTH AMERICAN LUNGFISH, *LEPIDOSIREN PARADOXA*. *Copeia* 1980(1):130-136. 1 Feb. 1980. SFA 25(2)

[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

80-001054 Peute, J.; M. Terlou; B. Breton; H. J. Th. Goos and P. G. W. J. Van Oordt. EFFECTS OF OVARIECTOMY ON GONADOTROPHS AND NLT OF THE RAINBOW TROUT. *Gen. Comp. Endocrinol.* 40(3):340. Mar. 1980. Abstract only. SFA 25(2)

[Zool. Lab., Utrecht, The Netherlands]

80-001055 Pic, P. and M. Djabali. EFFETS DE LA THEOPHYLLINE SUR LA CONCENTRATION BRANCHIALE EN AMP CYCLIQUE ET SUR LES TRANSFERTS BRANCHIAUX D'EAU CHEZ *MUGIL CAPITO* EN EAU DE MER. [THEOPHYLLINE EFFECTS ON CYCLIC AMP CONCENTRATION AND WATER TRANSFER IN THE GILLS OF *MUGIL CAPITO* IN SEA WATER]. *C.R. Hebd. Séances Acad. Sci. Sér. D Sci. Nat.* 289(4):417-420. 17 Sept. 1979. In French with English summ. SFA 25(2)

[Stn. Mar. Endoume, 13007 Marseille, France]

80-001056 Polenov, A. L.; M. A. Belenky and P. E. Garlov. THE HYPOTHALAMO-HYPOPHYSIAL SYSTEM IN ACIPENSERIDAE. VII. QUANTITATIVE ELECTRON MICROSCOPIC STUDY OF THE FUNCTIONAL STATE OF NEUROSECRETORY TERMINALS IN THE NEUROHYPOPHYSIS OF *ACIPENSER GÜLDENSTÀDTI* BRANDT DURING UPSTREAM MIGRATION AND AFTER SPAWNING. *Cell Tissue Res.* 203(2):311-320. Nov. 1979. SFA 25(2)

[Sechenov Inst., 194223, Leningrad, K-223, USSR]

80-001057 Prack, M.; B. Butler; P. Carolan; R. Martinez and V. L. de Vlaming. SEASONAL EFFECTS OF PROLACTIN ON ASPECTS OF CARBOHYDRATE AND LIPID METABOLISM IN THE GOLDFISH, *CARASSIUS AURATUS*. *Comp. Biochem.*

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80-001057 CONTINUED *Physiol. A Comp. Physiol.* 65(3):337-342. 1980. SFA 25(2)
[V. L. de Vlaming: Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-001058 Renaud, J. M. and T. W. Moon. CHARACTERIZATION OF GLUCONEOGENESIS IN HEPATOCYTES ISOLATED FROM THE AMERICAN EEL, *ANGUILLA ROSTRATA* LESUEUR. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 135(2):115-125. 1980. SFA 25(2)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-001059 Riehl, R. THE OCCURRENCE OF SPERMATOZOA IN THE OVARY OF NULLIPAROUS FEMALES OF *HETERANDRIA FORMOSA* AGASSIZ, 1853 (PISCES, POECILIIDAE). *Cell Tissue Res.* 205(2):289-294. Feb. 1980. SFA 25(2)
[Univ. Heidelberg, Im Neuenheimer Feld 324, D-6900 Heidelberg, West Germany]

80-001060 Rita Kumari, S. D. and N. B. Nair. OOGENESIS IN THE HILL STREAM LOACH *NOEMACHEILUS TRIANGULARIS* DAY. *Zool. Anz.* 203(3/4):259-271. 1979. SFA 25(2)
[Dep. Aquatic Biol. Fish., Univ. Kerala, Triwandrum, India]

80-001061 Roberts, D. E., Jr. PRELIMINARY RESULTS OF LABORATORY MAINTENANCE, INDUCED SEXUAL REVERSAL, AND SEXUAL MATURATION OF THE PROTOGYNOUS GROUPER, *MYCTEROPERCA MICROLEPIS*. *Fla. Sci.* 43(Suppl. 1):26. 1980. Abstract only. SFA 25(2)
[Fla. Dep. Nat. Resour. Mar. Res. Lab., 100 8th Ave. S.E., St. Petersburg 33701] Experimental observations indicate the grouper *Mycteroperca microlepis* is suitable for laboratory studies of sex reversal, induced sexual maturation, and spawning. Techniques are described for capture, transport and laboratory maintenance. Four female grouper (average = 593.5 mm SL: Age = 4+ yrs) with oocytes in the perinucleolus and early yolk vesicle stages of maturation were subjected to artificial conditions of photoperiod and temperature and oral application of 17 α Methyltestosterone for 120 days. After 60 days oviducts in all test fish were occluded; fin coloration deepened to irridescent blue black. After 120 days marbled color patterns were observed on the underbodies of two test fish. Control fish retained original coloration with no occlusion of oviducts. Effects of exogenous and endogenous stimuli on gametogenesis and sex reversal of this species are discussed in relation to ongoing experiments.

80-001062 Rogers, P. A.; A. R. Glenn and I. C. Potter. THE BACTERIAL FLORA OF THE GUT CONTENTS AND ENVIRONMENT OF LARVAL LAMPREYS. *Acta Zool. (Stockh.)* 61(1):23-27. 1980. SFA 25(2)
[Sch. Environ. Life Sci., Murdock Univ., Australia]

80-001063 Rott, N. N. CELL CYCLE IN EARLY EMBRYOGENESIS OF WHITEFISH. *Sov. J. Dev. Biol. (Engl. Transl. Ontogenez)* 10(3):167-195. Mar. 1980. SFA 25(2)
[Inst. Biol. Dev., Acad. Sci. USSR, Moscow]

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80-001064 Sakamoto, M. and K. Arai. [A FUNDAMENTAL STUDY ON RELATIONSHIP BETWEEN ATPase ACTIVITY AND CONTRACTILE PROPERTY OF FISH MYOFIBRILS.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1575-1583. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Dep. Dermatol., Univ. Calif. San Francisco, Sch. Med., San Francisco]

80-001065 Sand, O.; I. M. Petersen and B. Korsgaard-Emmersen. CHANGES IN SOME CARBOHYDRATE METABOLIZING ENZYMES AND GLYCOGEN IN LIVER, GLUCOSE AND LIPID IN SERUM DURING VITELLOGENESIS AND AFTER INDUCTION BY ESTRADIOL-17-β IN THE FLOUNDER (*PLATICHTYS FLESUS* L.). *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2)327-332. 1980. SFA 25(2)
[Inst. Biochem., Odense Univ., Compusvej 55, DK-5230 Odense M, Denmark]

80-001066 Saraswat, R. C. SOME ORGANIC CONSTITUENTS OF SCALES OF THE FISH *CHANNA PUNCTATUS* AT DIFFERENT STAGES OF GROWTH. *Indian J. Fish.* 23(1/2):265-268. 1976. SFA 25(2)
[K. R. Coll., Mathura, U.P., India]

80-001067 Satake, N. EFFECT OF MELATONIN AND METHIONINE-ENKEPHALIN ON SURFACING RESPONSES IN GOLDFISH. *Physiol. Behav.* 23(6):995-999. Dec. 1979. SFA 25(2)
[Sens. Sci. Lab., Univ. Hawaii, Honolulu 96822]

80-001068 Saunders, R. L. PHYSIOLOGICAL AND BEHAVIORAL PARAMETERS INVOLVED IN SALMONID SMOLTING WITH PARTICULAR REFERENCE TO ATLANTIC SALMON. *N. Am. Salmon Res. Cent. Rep.* No. 6. 16p. 1979. SFA 25(2)
[Biol. Stn., St. Andrews, NB E0G 2X0, Canada] A number of physiological and behavioral changes comprise the parr-smolt transformation which preadapts certain salmonids, while still in fresh water, for life in the sea. The physiological processes showing notable changes during smoltification are: body coloring, salinity tolerance and hypoosmotic regulation, growth rate and resulting condition factor, lipid and moisture contents, metabolic rate, carbohydrate metabolism, pituitary and thyroid activity, gill ATPase activity and buoyancy regulation. The behavioral changes are in salinity preference, spontaneous activity, territoriality, schooling, and migratory activity. These criteria of smolt status are described in relation to environmental factors which initiate the physiological and behavioral changes. Photoperiod has been identified as the priming factor which coordinates the various changes on a temporal basis. Temperature acts as a controlling factor determining the rates of change and finally as a releasing factor triggering migration.

80-001069 Schreibman, M. P. and L. R. Halpern. THE DEMONSTRATION OF NEUROPHYSIN AND ARGININE VASOTOCIN BY IMMUNOCYTOCHEMICAL METHODS IN THE BRAIN AND PITUITARY GLAND OF THE PLATYFISH, *XIPHOPHORUS MACULATUS*. *Gen. Comp. Endocrinol.* 40(1):1-7. Jan. 1980. SFA 25(2)
[Dep. Biol., Brooklyn Coll., Brooklyn, NY 11210]

80-001070 Schreibman, M. P. and H. Margolis-Kazan. THE IMMUNOCYTOCHEMICAL LOCALIZATION OF GONADOTROPIN, ITS SUBUNITS, AND THYROTROPIN IN THE TELEOST, *XIPHOPHORUS MACULATUS*. *Gen. Comp. Endocrinol.* 39(4):467-474. Dec. 1979. SFA 25(2)
[Brooklyn Coll. City Univ. N.Y., Brooklyn, NY 11210]

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80-001071 Seibert, H. THERMAL ADAPTATION OF HEART RATE AND ITS PARASYMPATHETIC CONTROL IN THE EUROPEAN EEL *ANGUILLA ANGUILLA* (L.). *Comp. Biochem. Physiol. C Comp. Pharmocol.* 64(2):275-278. 1979. SFA 25(2)
[Zool. Inst., Lehrstuhl Zoophysiol. Univ. Kiel, D-2300 Kiel, West Germany] Heart rate-temperature relationships were determined on unanaesthetized, unrestrained eels acclimated to 15°C and 25°C. Heart rate in eels with intact vagal tonus exhibited a nearly complete temperature compensation. The degree of compensation was considerably reduced by blocking the vagus function with benzetimide. The difference in the sensitivity of heart rate to temperature change induced by temperature acclimation was significantly decreased after benzetimide-treatment. The inhibitory vagal tonus was significantly higher in warm-acclimated than in cold-acclimated eels. It is concluded that adaptation of heart rate to temperature is mediated by the parasympathetic system to a great extent.

80-001072 Shackley, S. E. and P. E. King. LIPID YOLK SYNTHESIS IN A MARINE TELEOST, *BLENNIUS PHOLIS* L. *Cell Tissue Res.* 204(3):507-512. Dec. 1979. SFA 25(2)
[Zool. Dep., Univ. Coll. Swansea, Singleton Park, Swansea, U.K.]

80-001073 Shchekaturina, T. L. and O. G. Mironov. HYDROCARBON CHARACTERISTICS OF THE ORGANS AND TISSUES OF SOME MARINE FISHES FROM THE MEDITERRANEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1026-1029. 1978. SFA 25(2)
[Inst. Biol. South. Seas, Ukrainian SSR Acad. Sci., Sevastopol, USSR]

80-001074 Sidell, B. D. RESPONSES OF GOLDFISH (*CARASSIUS AURATUS*, L.) MUSCLE TO ACCLIMATION TEMPERATURE: ALTERATIONS IN BIOCHEMISTRY AND PROPORTIONS OF DIFFERENT FIBER TYPES. *Physiol. Zool.* 53(1):98-107. Jan. 1980. SFA 25(2)
[Dep. Zool., Univ. Me., Orono 04469]

80-001075 Singh, A. K. EFFECT OF THYROXINE AND THIOUREA ON LIVER AND MUSCLE ENERGY STORES IN THE FRESHWATER CATFISH, *HETEROPNEUSTES FOSSILLIS*. *Ann. Biol. Anim. Biochim. Biophys.* 19(6):1669-1676. 1979. In English with French summ. SFA 25(2)
[Dep. Zool., Gorakhpur Univ., Gorakhpur - 273 001, India]

80-001076 Smith, M. A. K.; R. W. Mathews; A. P. Hudson and A. E. V. Haschemeyer. PROTEIN METABOLISM OF TROPICAL REEF AND PELAGIC FISH. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):415-418. 1980. SFA 25(2)
[A.E.V. Haschemeyer: Dep. Biol. Sci., Hunter Coll. City Univ. N.Y., Box 741, New York 10021]

80-001077 Solbakken, J. E.; K. H. Palmork; T. Neppelberg and R. R. Scheline. URINARY AND BILIARY METABOLITES OF PHENANTHRENE IN THE COALFISH (*POLLACHIUS VIRENS*). *Acta Pharmacol. Toxicol.* 46(2):127-132. Feb. 1980. SFA 25(2)
[Inst. Fish. Biol., Univ. Bergen, Nordnesparken 29, 5011 Bergen-Nordnes, Norway]

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80-001078 Spanovskaya, V. D. and V. V. Roldugina. SOME BLOOD INCATORS IN THE ROACH, *RUTILUS RUTILUS*, FROM MOZHAYSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):960-967. 1978. SFA 25(2)

[Dep. Ichthyol., Moscow Univ., USSR] In sexually mature males of the roach, *Rutilus rutilus*, from Mozhaysk reservoir the concentration of hemoglobin and number of erythrocytes are higher than in the females, and the value of these indicators decreases as the fish age. The number of leukocytes and the range of variability of this indicator are greater in females than in males. In the course of the summer the highest indicators of hemoglobin content were observed in May and August, and of number of leukocytes in May and July.

80-001079 Spieler, R. E. DIEL RHYTHMS OF CIRCULATING PROLACTIN, CORTISOL, THYROXINE, AND TRIIODOTHYRONINE LEVELS IN FISHES: A REVIEW. *Rev. Can. Biol.* 38(4):301-315. Dec. 1979. In English with French summ. SFA 25(2)

[Vert. Div., Milwaukee Pub. Mus., 800 W. Wells St., Milwaukee, WI 52333]

80-001080 Subramanian, A. SALINITY ADAPTATION IN THE SNAKE EEL *PISOODONOPHIS BORO* (HAM-BUCH). *Rev. Can. Biol.* 38(3):167-171. Sept. 1979. In English with French summ. SFA 25(2)

[Cent. Adv. Stud. Mar. Biol,. Annamalai Univ., Parangipettai 608 502, India] The snake eel *Pisoodonophis boro* (Family Ophichthidae) burrows, causing leaks in the bunds and damaging the salterns and paddy fields adjoining estuaries. The animal's capability to withstand brine in salterns and fresh water in paddy fields was determined from laboratory experiments. The eel tolerated salinities ranging from deionized water to 75°/oo. Adaptation to fresh water as well as full strength seawater was completed within 24 h. The concentration of sodium and chloride in the blood varied by 10-20% on transfer from seawater to fresh water. *P. boro* can survive in paddy fields but not in salterns. However, their occurrence in both is described as a rare phenomenon and not obligatory.

80-001081 Sugimoto, Y. and H. Takahashi. ULTRASTRUCTURAL CHANGES OF TESTICULAR INTERSTITIAL CELLS OF SILVER JAPANESE EELS, *ANGUILLA JAPONICA*, TREATED WITH HUMAN CHORIONIC GONADOTROPIN. *Bull. Fac. Fish. Hokkaido Univ.* 30(1):23-33. Feb. 1979. SFA 25(2)

[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-001082 Sugita, H.; Y. Ishida and H. Kadota. [MEDIA FOR THE ENUMERATION AND ISOLATION OF AEROBIC BACTERIA IN GASTROINTESTINE OF *TILAPIA NILOTICA*.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):91-95. Jan. 1980. In Japanese with English summ.

[Dep. Fish., Fac. Agric., Kyoto Univ., Kyoto 606, Japan]

80-001083 Sumpter, J. P.; N. Jenkins; R. T. Duggan and J. M. Dodd. THE STEROIDOGENIC EFFECTS OF PITUITARY EXTRACTS FROM A RANGE OF ELASMOBRANCH SPECIES ON ISOLATED TESTICULAR CELLS OF QUAIL, AND THEIR NEUTRALISATION BY A DOGFISH ANTI-GONADOTROPHIN. *Gen. Comp. Endocrinol.* 40(3):331. Mar. 1980. Abstract only. SFA 25(2)

[Dep. Appl. Biol., Brunel Univ., Uxbridge, Middlesex UB8 3PH, England]

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[Dep. Agric. Chem., Tokyo Univ. Agric., Setagaya-ku 156, Tokyo, Japan]

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80-001085 Suzuki, Y.; M. Nakahara; R. Nakamura and T. Ueda. ROLES OF FOOD AND SEA WATER IN THE ACCUMULATION OF RADIONUCLIDES BY MARINE FISH. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1409-1416. Nov. 1979. SFA 25(2)
[Div. Mar. Radioecol., Natl. Inst. Radioecol. Sci., 3609, Isozaki, Nakaminato, Ibaraki 311-12, Japan]

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[Div. Mar. Radioecol., Natl. Inst. Radiol. Sci. 36091 Isozaki, Nakaminato, Ibaraki, Japan]

80-001087 Takahashi, H. [TWO NEW CASES OF HERMAPHRODITIC GONADS FOUND IN ARTIFICIALLY MATURED JAPANESE EELS, *ANGUILLA JAPONICA*.] *Bull. Fac. Fish. Hokkaido Univ.* 30(4):252-258. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-001088 Takashima, Y.; K. Takano and A. Hara. [CHANGES IN FEMALE-SPECIFIC SERUM PROTEINS DURING THE COURSE OF INDUCED MATURATION OF FEMALE JAPANESE EELS (*ANGUILLA JAPONICA*)]. *Bull. Fac. Fish. Hokkaido Univ.* 30(1):50-61. Feb. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-001089 Tandon, R. S. and S. Chandra. ECOPHYSIOLOGY OF FISHES: EFFECT OF STARVATION ON BLOOD UREA LEVELS OF FRESHWATER CATFISH *CLARIAS BATRACHUS*. *J. Anim. Physiol. Anim. Nutr.* 41(6):310-313. May 1979. In English with German summ. SFA 25(2)
[Dep. Zool., Lucknow Univ., Lucknow, West Germany]

80-001090 Taylor, D. J. THE EFFECT OF HYPOPHYSECTOMY, THYROXINE, PROLACTIN, PHOTOPERIOD AND TEMPERATURE ON THE RHODOPSIN-PORPHYROPSIN RATIOS OF TWO TROUT, *SALVELINUS FONTINALIS* AND *SALMO GAIRDNERI*. *Ph.D. dissertation, Cornell Univ.* 93p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3565. Feb. 1980. SFA 25(2)

80-001091 Terkatin-Shimony, A.; Z. Ilan; Z. Yaron and D. W. Johnson. RELATIONSHIP BETWEEN TEMPERATURE, OVARIAN RECRUDESCENCE, AND PLASMA CORTISOL LEVEL IN *TILAPIA AUREA* (CICHLIDAE, TELEOSTEI). *Gen. Comp. Endocrinol.* 40(2):143-148. Feb. 1980. SFA 25(2)
[Dep. Zool., George S. Wise Cent. Life Sci., Tel-Aviv Univ., Tel-Aviv, Israel]

80-001092 Thorpe, A. and H. Duve. THE ISOLATED ISLETS OF LANGERHANS OF THE SILVER EEL, *ANGUILLA ANGUILLA*, IN CULTURE. *Gen. Comp. Endocrinol.* 40(3):351-352. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool. Comp. Physiol., Queen Mary Coll., Univ. London, England]

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80-001093 Tomasso, J. R.; K. B. Davis and N. C. Parker. PLASMA CORTICOSTEROID AND ELECTROLYTE DYNAMICS OF HYBRID STRIPED BASS (WHITE BASS X STRIPED BASS) DURING NETTING AND HAULING STRESS. *J. Tenn. Acad. Sci.* 55(2):54. Apr. 1980. Abstract only. SFA 25(2)

[Memphis State Univ., Memphis, TN] Netting and hauling-induced stress was evaluated in reciprocal striped bass hybrids (*Morone chrysops* female x *Morone saxatilis* male) using changes in plasma corticosteroid levels as a general indicator of stress and changes in plasma chloride levels as an indicator of osmoregulatory dysfunction. Fish confined in a net for 10 minutes exhibited significantly elevated corticosteroid levels (24.2±5.4 µl/100 ml) and slight hyperchloremia (150.0±2.7 meq/liter) when compared to baseline levels (0.8±0.1 µg/100 ml and 132.6 ± 1.5 meq/liter, respectively). Hauling hybrid striped bass for 2 hours in fresh water significantly elevated corticosteroid levels (12.2 ± 1.2 µg/100 ml) and reduced chloride levels (119.8 ± 1.4 meq/liter). Corticosteroid levels remained high and hypochloremia developed within 24 hours of both netting and hauling. Netting and hauling in 25 mg/liter MS-222 or 10 g/liter NaCl prevented chloride depletion during the stress, but hypochloremia developed within 72 hours of recovery in fresh water. Hauling in a combination of MS-222 and NaCl prevented hypochloremia for up to 72 hours after hauling; plasma corticosteroids, elevated during the haul, returned to near baseline levels within 24 hours. The development of hypochloremia several hours after handling indicates that, although hybrid bass survive the initial stress, survival may be reduced in the days following handling. A combination of 25 mg/liter MS-222 and 10 g/liter salt was the most successful handling medium tested.

80-001094 van Bohemen, Ch. G. and J. G. D. Lambert. INDUCTION AND ANNUAL PLASMA LEVELS OF YOLK PROTEINS IN *SALMO GAIRDNERI*. *Gen. Comp. Endocrinol.* 40(3):319. Mar. 1980. Abstract only. SFA 25(2)

[Zool. Lab., Padualaan 8, Utrecht, The Netherlands]

80-001095 Van Den Hurk, R.; G. A. Slof and F. A. Schurer. GONADAL SEX DIFFERENTIATION IN RAINBOW TROUT, *SALMO GAIRDNERI* WITH SPECIAL REFERENCE TO THE EFFECTS OF STEROID HORMONES AND N,N-DIMETHYLFORMAMIDE. *Gen. Comp. Endocrinol.* 40(3):323. Mar. 1980. Abstract only. SFA 25(2)

[Zool. Lab., Utrecht, The Netherlands]

80-001096 van Kemenade, J. A. M.; H. J. M. Goverde and A. P. M. Lamers. THE ADRENOCORTICAL TISSUE AND ACTH IN THE TROUT, *SALMO GAIRDNERI*: ANNUAL CYCLES. *Gen. Comp. Endocrinol.* 40(3):346. Mar. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Med. Fac., Univ. Nijmegen, Nijmegen, The Netherlands]

80-001097 Van Veen, Th.; P. Ekström; B. Borg and M. Møller. A LIGHT, FLUORESCENCE, AND ELECTRON MICROSCOPICAL INVESTIGATION OF THE PINEAL ORGAN OF THE THREE-SPINED STICKLEBACK. *Gen. Comp. Endocrinol.* 40(3):368. Mar. 1980. Abstract only. SFA 25(2)

[Dep. Zool., Univ. Lund, Lund, Sweden]

80-001098 Vislie, T. CELL VOLUME REGULATION IN ISOLATED, PERFUSED HEART VENTRICLE OF THE FLOUNDER (*PLATICHTHYS FLESUS*). *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):19-27. 1980. SFA 25(2)

[Zool. Inst., Univ. Oslo, Box 1050, Blindern, Oslo 3, Norway]

PHYSIOLOGY

80-001099 Watanabe, K. and S. Konosu. INCORPORATION OF ^{14}C-HISTIDINE INTO CARNOSINE IN THE EEL, *ANGUILLA JAPONICA*. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1513-1516. Dec. 1979. SFA 25(2)
[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

80-001100 Watson, D. and J. Bastian. FREQUENCY RESPONSE CHARACTERISTICS OF ELECTRORECEPTORS IN THE WEAKLY ELECTRIC FISH, *GYMNOTUS CARAPO*. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 134(3):191-202. 1979. SFA 25(2)
[Sect. Neurobiol. Behav., Cornell Univ., Ithaca, NY 14853]

80-001101 Weihs, D. ENERGETIC SIGNIFICANCE OF CHANGES IN SWIMMING MODES DURING GROWTH OF LARVAL ANCHOVY, *ENGRAULIS MORDAX*. *NOAA Fish. Bull.* 77(3):597-604. July 1979. SFA 25(2)
[Dep. Aeronaut. Eng., Technion, Haifa, Israel] The swimming behavior of larval northern anchovy, *Engraulis mordax*, in the first few days after hatching is different from the intermittent beat-and-glide mode used by older larvae and later stage fish. It is shown mathematically that the bursts of continuous swimming typical of these yolk-sac larvae is the more efficient form of locomotion at this stage, because of their small size. This advantage changes as the larva grows out of the size range in which water viscosity is the dominant factor (small Reynolds number). When the larva reaches a length of 5 mm, typical Reynolds numbers are such that intermittent swimming gradually becomes the more economical mode, and this mode is dominant when the larvae reach 15 mm. These analytical results compare well with observed behavioral changes.

80-001102 Wendelaar Bonga, S. E. and J. C. A. Van Der Meij. THE ROLE OF ENVIRONMENTAL CALCIUM IN THE CONTROL OF PROLACTIN SECRETION IN THE TELEOST *SAROTHERODON MOSSAMBICUS (TIPAPIA MOSSAMBICA)*. *Gen. Comp. Endocrinol.* 40(3):342. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Nijmegen, Nijmegen, The Netherlands]

80-001103 Wendelaar Bonga, S. E. EFFECT OF SYNTHETIC SALMON CALCITONIN AND LOW AMBIENT CALCIUM ON PLASMA CALCIUM, ULTIMOBRANCHIAL CELLS, STANNIUS BODIES, AND PROLACTIN CELLS IN THE TELEOST *Gasterosteus aculeatus*. *Gen. Comp. Endocrinol.* 40(1):99-108. Jan. 1980. SFA 25(2)
[Univ. Nijmegen, Dep. Zool., Nijmegen, The Netherlands]

80-001104 Whitehead, C.; N. R. Bromage; R. Harbin and A. J. Matty. OESTRADIOL-17β, CALCIUM, AND VITELLOGENIN INTERRELATIONSHIPS DURING ACCELERATED AND BIANNUAL SPAWNINGS IN THE RAINBOW TROUT. *Gen. Comp. Endocrinol.* 40(3):329-330. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Biol. Sci., Univ. Aston, Birmingham B4 7ET, England]

80-001105 Wood, C. M.; P. Pieprzak and J. N. Trott. THE INFLUENCE OF TEMPERATURE AND ANAEMIA ON THE ADRENERGIC AND CHOLINERGIC MECHANISMS CONTROLLING HEART RATE IN THE RAINBOW TROUT. *Can. J. Zool.* 57(12):2440-2447. Dec. 1979. In English with French summ. SFA 25(2)
[Dep. Biol., McMaster Univ., 1280 Main St. West, Hamilton, ON L8S 4K1, Canada]

80-001106 Wright, G. M. THE ENDOSTYLE, THYROID, AND METAMORPHOSIS IN THE ANADROMOUS SEA LAMPREY, *PETROMYZON MARINUS* L. *Ph.D. dissertation, Univ. Toronto (Canada)* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3623. Feb. 1980. SFA 25(2)

PHYSIOLOGY

80-001107 Yakovleva, I. V. and N. A. Yefimova. COMPARATIVE DETERMINATION OF THYROTROPIC HORMONE IN THE PITUITARY OF *ACIPENSER GULDENSTADTI* LARVAE AND FINGERLINGS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):807-815. 1978. SFA 25(2)
[I. M. Sechenov Inst. Evol. Physiol. Biochem., USSR Acad. Sci., Leningrad, USSR]

80-001108 Yamaguchi, K.; N. Takeda; K. Ogawa and K. Hashimoto. [PROPERTIES OF MACKEREL AND SARDINE MYOGLOBINS]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1335-1339. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

80-001109 Yamamoto, K.; Y. Itazawa and H. Kobayashi. SUPPLY OF ERYTHROCYTES INTO THE CIRCULATING BLOOD FROM THE SPLEEN OF EXERCISED FISH. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):5-11. 1980. SFA 25(2)
[Ono Limnol. Stn., Shimonoseki Univ. Fish., Ono, Ube, 754-13, Japan] Hematocrit and hemoglobin concentrations of yellowtail blood elevated more than 40% just after a severe exercise by 5 min chasing. About 40% of the hematocrit elevation is considered to have been caused by erythrocyte supply from the spleen, and other 35% by blood condensation due to water shift out of the plasma. Similar phenomena were observed in a cruising experiment.

80-001110 Yaron, Z. and Z. Ilan. STIMULATION OF CORTISOL SECRETION FROM SUPERFUSED INTERRENAL TISSUE OF *TILAPIA AUREA* BY ACTH OR DB cAMP. *Gen. Comp. Endocrinol.* 40(3):349. Mar. 1980. Abstract only. SFA 25(2)
[Zool. Dep., Tel-Aviv Univ., Tel-Aviv, Israel]

80-001111 Yarzhombek, A. A. and V. I. Rozhdestvenskaya. FATIGUE AND ELECTRICALLY INDUCED FATIGUE IN FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):832-838. 1978. SFA 25(2)
[VNIRO, Moscow, USSR] A study was made of the fatigue of the motor system of fishes on natural stimulation of motor activity (frightening, optomotor reaction) and on electrical stimulation of muscular contractions. The reduction in the efficiency of the muscles following electrical stimulation is not identical to the process of natural fatigue. Nevertheless, research involving electrical stimulation can give some idea of the relative efficiency of the muscles.

80-001112 Yorke, M. A. and D. B. McMillan. NATURE AND CELLULAR ORIGIN OF THE ADHESIVE COATS OF THE LAMPREY EGG (*PETROMYZON MARINUS*). *J. Morphol.* 162(3):313-326. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. West. Ontario, London, ON N6A 5B7, Canada]

80-001113 Yoshikawa, H. and M. Oguri. GONADAL SEX DIFFERENTIATION IN THE MEDAKA, *ORYZIAS LATIPES*, WITH SPECIAL REGARD TO THE GRADIENT OF THE DIFFERENTIATION OF TESTES. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1115-1121. Sept. 1979. SFA 25(2)
[Fish. Lab., Fac. Agric., Nagoya Univ., Furo-cho, Nagoya 464, Japan]

PHYSIOLOGY

80-001114 Young, G. and J. N. Ball. EFFECTS OF LH-RH ON THE ULTRASTRUCTURE OF THE GONADOTROPHIC CELLS OF THE PITUITARY OF *POECILIA LATIPINNA* (TELEOSTEI) IN VIVO AND IN VITRO. *Gen. Comp. Endocrinol.* 40(3):341-342. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Sheffield, Sheffield, England]

80-001115 Young, J. Z. NERVOUS CONTROL OF STOMACH MOVEMENTS IN DOGFISHES AND RAYS. *J. Mar. Biol. Assoc. UK* 60(1-17. Feb. 1980. SFA 25(2)
[Wellcome Inst. Hist. Med., 183 Euston Rd., London, England]

80-001116 Young, J. Z. NERVOUS CONTROL OF GUT MOVEMENTS IN *LOPHIUS*. *J. Mar. Biol. Assoc. UK* 60(1):19-30. Feb. 1980. SFA 25(2)
[Wellcome Inst. Hist. Med., 183 Euston Rd., London, England]

80-001117 Yu, J. Y.-L.; W. W. Dickhoff; Y. Inui and A. Gorbman. SEXUAL PATTERNS OF PROTEIN METABOLISM IN LIVER AND PLASMA OF HAGFISH, *EPTATRETUS STOUTI* WITH SPECIAL REFERENCE TO VITELLOGENESIS. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(1):111-117. 1980. SFA 25(2)
[Dep. Zool., Univ. Wash., Seattle 98195]

80-001118 Zohar, Y. and H. Gordin. SPAWNING KINETICS IN THE GILTHEAD SEA-BREAM, *SPARUS AURATA* L. AFTER LOW DOSES OF HUMAN CHRONIC GONADOTROPIN. *J. Fish Biol.* 15(6):665-670. Dec. 1979. SFA 25(2)
[Lab. Physiol. Poissons, I.N.R.A., 7835 Jouy en Josas, France] This paper reports the temporal pattern of hormonally induced spawning in *Sparus aurata* females reared in captivity. A low dose of human chorionic gonadotropin (100-400 i.u./kg body weight), administered to females with oocytes in the last stages of vitellogenesis, induced a daily cycle of maturation, ovulation and spawning of fertilizable eggs. This cycle pattern lasted for a period of 4-100 days. In fish injected with saline and most of the untreated fish, all vitellogenetic eggs underwent rapid atresia.

80-001119 Zwingelstein, G.; J. Portoukalian; G. Rebel and G. Brichon. GILL SULFOLIPID SYNTHESIS AND SEAWATER ADAPTATION IN EURYHALIN FISH, *ANGUILLA ANGUILLA*. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(3):555-558. 1980. SFA 25(2)
[CNRS, Lab. Physiol. Gen. Comp., Univ. Claude Bernard, Lyon I, 69622 Villeurbonne, France]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001120 Ayling, A. M. HYBRIDIZATION IN THE GENUS *PSEUDOLABRUS* (LABRIDAE). *Copeia* 1980(1):176-180. 1 Feb. 1980. SFA 25(2)
[Mar. Res. Found., Box 2047, Cairns, Queensland, 4870, Australia]

80-001121 Bailey, J. K. and R. L. Saunders. PRELIMINARY REPORT ON RELEASES AND RETURNS OF TWO YEAR-CLASSES OF ATLANTIC SALMON SMOLTS FROM VARIOUS PURE STRAINS AND STRAIN CROSSES. *N. Am. Salmon Res. Cent. Rep.* No. 5. 6p. 1979. SFA 25(2)
[Huntsman Mar. Lab., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Three different river strains of 1974 year-class Atlantic salmon, released as small

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80-001121 CONTINUED (mean=14.1 cm) one-year smolts in 1976 produced about two times more two sea winter adults returns than grilse. The grilse from this release averaged 55.0 cm fork length. The same three strains plus all six possible hybrid combinations planted in 1977 as large (>20 cm) two-year smolts returned a much higher proportion of grilse. The mean length of the grilse returns was 59.6 cm. Four river strains and all 12 hybrid combinations of 1975 year-class salmon released as large (>18 cm) one-year smolts in 1977 returned few medium sized (mean=56.6 cm) grilse. Smolt age, size, and genetic origin appears to influence the size of returning grilse and the grilse-larger salmon ratio.

80-001122 Berrebi, P. and J. Britton-Davidian. ENZYMATIC SURVEY OF FOUR POPULATIONS OF *ATHERINA BOYERI* BASED ON ELECTROPHORESIS AND THE OCCURRENCE OF A MICROSPORIDIOSIS. *J. Fish Biol.* 16(2):149-157. Feb. 1980. SFA 25(2)
[Lab. Ichthyol. Parasitol. Gen., Univ. Montpellier II, Place Eugène Bataillon 34060 Montpellier, France]

80-001123 Blanc, J. M.; B. Chevassus and P. Bergot. DÉTERMINISME GÉNÉTIQUE DU NOMBRE DE CŒCA PYLORIQUES CHEZ LA TRUITE FARIO (*SALMO TRUTTA*, LINNÉ) ET LA TRUITE ARC-EN-CIEL (*SALMO GAIRDNERI*, RICHARDSON). III.--EFFET DU GÉNOTYPE ET DE LA TAILLE DES OEUFS SUR LA RÉALIZATION DU CARACTÈRE CHEZ LA TRUITE FARIO. [GENETIC DETERMINISM OF THE NUMBER OF PYLORIC CAECA IN BROWN TROUT (*SALMO TRUTTA*) AND RAINBOW TROUT (*SALMO GAIRDNERI*). III--INFLUENCE OF THE GENOTYPE AND EGG SIZE ON THE REALIZATION OF THE CHARACTER IN BROWN TROUT.] *Ann. Genet. Sel. Anim.* 11(1):93-103. 1979. In French with English summ. SFA 25(2)
[Lab. Ecol. Poissons, Cent. Rech. Hydrobiol., I.N.R.A., Saint-Pée-sur-Nivelle, 64310 Ascain, France]

80-001124 Chevassus, B.; J. M. Blanc and P. Bergot. DÉTERMINISME GÉNÉTIQUE DU NOMBRE DE CŒCA PYLORIQUES CHEZ LA TRUITE FARIO (*SALMO TRUTTA*, LINNÉ) ET LA TRUITE ARC-EN-CIEL (*SALMO GAIRDNERI*, RICHARDSON). II.--EFFET DU GÉNOTYPE DU MILIEU D'ELEVAGE ET DE L'ALIMENTATION SUR LA RÉALISATION DU CARACTÉRE CHEZ LA TRUITE ARC-EN-CIEL. [GENETIC ANALYSIS OF THE NUMBER OF PYLORIC CAECA IN BROWN TROUT (*SALMO TRUTTA*, LINNÉ) AND RAINBOW TROUT (*SALMO GAIRDNERI*, RICHARDSON). II--EFFECT OF THE GENOTYPE, REARING ENVIRONMENT AND FEEDING ON THE REALIZATION OF THE CHARACTER IN RAINBOW TROUT.] *Ann. Genet. Sel. Anim.* 11(1):79-92. 1979. In French with English summ. SFA 25(2)
[Lab. Physiol. Poissons, Cent. Natl. Rech. Zootech., I.N.R.A., 78350 Jouy-en-Josas, France]

80-001125 Chilcote, M. W.; B. A. Crawford and S. A. Leider. A GENETIC COMPARISON OF SYMPATRIC POPULATIONS OF SUMMER AND WINTER STEELHEADS. *Trans. Am. Fish. Soc.* 109(2):203-206. Mar. 1980. SFA 25(2)
[Wash. Dep. Game, 600 N. Capitol Way, Olympia 98504]

80-001126 Cokendolpher, J. C. HYBRIDIZATION EXPERIMENTS WITH THE GENUS *CYPRINODON* (TELEOSTEI: CYPRINODONTIDAE). *Copeia* 1980(1):173-176. 1 Feb. 1980. SFA 25(2)
[Mus. Biol. Sci., Tex. Tech Univ., Lubbock 79409]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001127 Felley, J. ANALYSIS OF MORPHOLOGY AND ASYMMETRY IN BLUEGILL SUNFISH (*LEPOMIS MACROCHIRUS*) IN THE SOUTHEASTERN UNITED STATES. *Copeia* 1980(1):18-29. 1 Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Okla., Norman 73019]

80-001128 Felley, J. D. and J. C. Avise. GENETIC AND MORPHOLOGICAL VARIATION OF BLUEGILL POPULATIONS IN FLORIDA LAKES. *Trans. Am. Fish. Soc.* 109(1):108-115. Jan. 1980. SFA 25(2)
[Dep. Zool., Univ. Okla., Norman 73019]

80-001129 Friars, G. W.; J. K. Bailey and R. L. Saunders. CONSIDERATIONS OF A METHOD OF ANALYZING DIALLEL CROSSES OF ATLANTIC SALMON. *Can. J. Genet. Cytol.* 21:121-128. 1979. In English with French summ. SFA 25(2)
[Dep. Anim. Poultry Sci., Univ. Guelph, Guelph, ON, Canada] Inferences derived from a proposed mixed model analysis of a diallel cross involving four stocks of Atlantic salmon (*Salmo salar*) are illustrated with growth data on weight and length. Variation between stocks was more apparent when samples represented dams as opposed to sires, thus stressing the relative importance of maternal effects. However, the ranking of stocks was not altered when either the means of sire sources or the means of dam sources were considered. No heterotic effects were found for the growth traits studied.

80-001130 Fujio, Y. and Y. Kato. GENETIC VARIATION IN FISH POPULATIONS. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1169-1178. Sept. 1979. SFA 25(2)
[Dep. Fish. Sci., Fac. Agric., Tohaku Univ., Sendai 980, Japan]

80-001131 Gold, J. R.; W. J. Karel and M. R. Strand. CHROMOSOME FORMULAE OF NORTH AMERICAN FISHES. *Prog. Fish-Cult.* 42(1):10-23. Jan. 1980. SFA 25(2)
[Genet. Sect., Tex. A&M Univ., College Station 77843]

80-001132 Hirshfield, M. F.; C. R. Feldmeth and D. L. Soltz. GENETIC DIFFERENCES IN PHYSIOLOGICAL TOLERANCES OF AMARGOSA PUPFISH (*CYPRINODON NEVADENSIS*) POPULATIONS. *Science* 207(4434):999-1001. 29 Feb. 1980. SFA 25(2)
[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612] Amargosa pupfish from a constant-temperature spring have a narrower range of temperature and oxygen tolerances than pupfish from the much more variable Amargosa River, indicating that the two populations have diverged genetically since their isolation. The reduced tolerances of the fish inhabiting a constant environment support the predictions of evolution theory.

80-001133 Holder, V. P. and C. J. Biggers. INVESTIGATION OF IMPROVEMENT IN ELECTROPHORETIC SEPARATION OF PLASMA ALBUMIN OF THE CHANNEL CATFISH, *ICTALURUS PUNCTATUS*. *J. Tenn. Acad. Sci.* 55(2):57-58. Apr. 1980. Abstract only. SFA 25(2)
[Memphis State Univ., Memphis, TN]

80-001134 Hudson, R. G.; G. B. Pardue and J. F. Roberts. ICTALURID CHROMOSOME PREPARATION BY CELL CULTURE AND SQUASH METHODS. *Prog. Fish-Cult.* 42(1):43-45. Jan. 1980. SFA 25(1)
[Dep. Biol., Presbyterian Coll., Clinton, SC 29325]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001135 Khula-Bukhsh, A. R. A HIGH NUMBER OF CHROMOSOMES IN THE HILLSTREAM CYPRINID, *TOR PUTITORA* (PISCES). *Experientia (Basel)* 36(2):173-174. 15 Feb. 1980. SFA 25(2)

[Dep. Zool., Univ. Kalyani, Kalyani-741235, India] The karyotype of a cyprinid fish occurring in India, *Tor putitora*, is described. The diploid complement comprises 100 chromosomes. The modal number in this family being 2n=50, *T. putitora* appears to be another case of tetraploidy.

80-001136 Kormilin, V. V.; R. M. Tsoy; Zh. G. Sarsembayev and N. Ch. Artygaliyev. THE EFFECT OF CHEMICAL MUTAGENS ON SPERMATOZOA OF THE SILVER CARP, *HYPOPHTHALMICHTHYS MOLITRIX*, AND THE BIGHEAD, *ARISTICHTHYS NOBILIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1030-1033. 1978. SFA 25(2)

[KazNIIRKh, Alma-Ata, USSR] Processing with chemical mutagens of ripe spermatozoa from the silver carp and bighead does not influence the process of fertilization of the eggs negatively. More than that, NEU, NMB and DMS have a stimulating effect expressed in the silver carp in a higher percentage of fertilization. As a result of fertilization of a normal egg of the bighead with spermatozoa treated by chemical mutagens, a sharp increase in the number of aberrant forms is observed among the developed embryos. The number of abnormal embryos is in direct relation to the concentration of mutagens. Ripe spermatozoa from the silver carp proved more resistant to mutagenic action that those of the bighead.--Concl.

80-001137 Leibel, W. S. THE ESTERASE DILEMMA: A COMPARATIVE BIOCHEMISTRY OF FISH ESTERASES. *Ph. D. dissertation, Yale Univ.* 299p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2490. Dec. 1979. SFA 25(2)

80-001138 Márián, T. and Z. Krasznai. COMPARATIVE KARYOLOGICAL STUDIES ON CHINESE CARPS. *Aquaculture* 18(4):325-336. Dec. 1979. SFA 25(2)

[Fish Cult. Res. Inst., Genet. Breed. Dep., P.O. Box 47, H-5541 Szarvas, Hungary]

80-001139 Mitchell, C. P. and D. Scott. MUSCLE MYOGENS IN THE NEW ZEALAND GALAXIIDAE. *N.Z. J. Mar. Freshwater Res.* 13(2):285-294. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., Nyapuna, Rotorua, New Zealand]

80-001140 Moore, F. D. and A. M. White. LACTATE DEHYDROGENASE ISOZYME PATTERN OF NATURAL LONGNOSE DACE X BLACKNOSE DACE HYBRIDS. *Ohio J. Sci.* 80:14. 1980. Abstract only. SFA 25(2)

[Dep. Biol., John Carroll Univ., Cleveland, OH 44118] During a study of enzyme polymorphism in Chagrin River populations of Longnose Dace (*Rhinichthys cataractae*) we observed an exceptional pattern of cytosolic lactate dehydrogenase (LDH) in nine specimens of the 179 examined. Although the specimens possessing the exceptional pattern exhibited Longnose Dace coloration, pigmentation and general body form, morphometric examination revealed that the lateral line scale counts were low, (range 57-63) and that the eye diameter to snout length ratio was consistantly less than 1.8. Scale counts for the remainder of the population (n=107) were 69.3 ± 4.2 and the eye to snout ratio was 2.37 ± 0.21. These data suggested that the specimens might be hybrids with another species, thus we conducted an electrophoretic investigation to determine other possible parental species. Of all other species examined, only the Blacknose Dace (*Rhinichthys atratulus*) possessed LDH isozymes with the appropriate mobility. Mixtures of liver extracts from both dace produced a pattern indistinguishable from the exceptional pattern. We feel that the combination of the mixed LDH isozyme pattern and the intermediate morphometric characters indicate that these specimens represent naturally occuring hybrids of these two similar species.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001141 Morizot, D. C. and M. J. Siciliano. POLYMORPHISMS, LINKAGE AND MAPPING OF FOUR ENZYME LOCI IN THE FISH GENUS *XIPHOPHORUS* (POECILIIDAE). *Genetics* 93(4):947-960. Dec. 1979. SFA 25(2)
[Univ. Tex. Grad. Sch. Biomed. Sci., Houston 77030]

80-001142 Ojima, Y. and A. Takai. FURTHER CYTOGENETICAL STUDIES ON THE ORIGIN OF THE GOLD-FISH. *Proc. Jpn. Acad. B. Phys. Biol. Sci.* 55(7):346-350. Sept. 1979. SFA 25(2)
[Dep. Biol., Fac. Sci., Kwansei Gakuin Univ., Nishinomiya, Japan]

80-001143 Ojima, Y. and E. Kashiwagi. A KARYOTYPE STUDY OF ELEVEN SPECIES OF LABRID FISHES FROM JAPAN. *Proc. Jpn. Acad. Ser. B Phys. Biol. Sci.* 45(6):280-285. June 1979. SFA 25(2)
[Dep. Biol., Fac. Sci., Kwansei Gakuin Univ., Nishinomiya, Japan]

80-001144 Payusova, A. N. ELECTROPHORETIC ANALYSIS OF THE BLOOD SERUM OF TWO SPECIES OF ISSYK-KUL DACE - *LEUCISCUS SCHMIDTI* AND *L. BERGI*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):800-806. 1978. SFA 25(2)
[Biol. Fac., Moscow Univ., USSR] Electrophoresis in polyacrylamide gel was used to investigate the protein spectrum of the blood serum of two Issyk-Kul dace species (*Leuciscus*). Individual variability was discovered in the spectra connected with sex and the maturity stage of the gonads, and also with polymorphism of transferrin. The two closely related species have identical blood serum spectra.

80-001145 Philipp, D. P.; W. F. Childers and G. S. Whitt. EVOLUTION OF PATTERNS OF DIFFERENTIAL GENE EXPRESSION: A COMPARISON OF THE TEMPORAL AND SPATIAL PATTERNS OF ISOZYME LOCUS EXPRESSION IN TWO CLOSELY RELATED FISH SPECIES (NORTHERN LARGEMOUTH BASS, *MICROPTERUS SALMOIDES SALMOIDES*, AND SMALLMOUTH BASS, *MICROPTERUS DOLOMIEUI*). *J. Exp. Zool.* 210(3):473-488. Dec. 1979. SFA 25(2)
[Dep. Genet. Dev., Univ. Ill., Urbana]

80-001146 Pontier, P. J. GENETIC CONTROL OF ISOZYME EXPRESSION DURING THE DEVELOPMENT OF TWO TELEOSTS, *BRACHYDANIO RERIO* AND *BRACHYDANIO ALBOLINEATUS*. *Ph.D. dissertation, Rutgers Univ.* 209p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(7):3045. Jan. 1980. SFA 25(2)

80-001147 Riddell, B. E. ENVIRONMENTAL AND GENETIC SOURCES OF GEOGRAPHIC VARIATION IN POPULATIONS OF ATLANTIC SALMON, *SALMO SALAR* LINNAEUS. *Ph.D. dissertation, McGill Univ. (Canada)* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4104. Mar. 1980. SFA 25(2)

80-001148 Serra, V. and R. Mandarino. SHORT PERIOD INTERSPERSION PATTERN IN THE GENOME OF A TELEOSTEAN FISH. *J. Exp. Zool.* 210(3):515-520. Dec. 1979. SFA 25(2)
[Dep. Biol. Cell., Univ. Calabria, 87030 Arcavacata di Rende (CS), Italy]

80-001149 Sidell, B. D. and K. F. Beland. LACTATE DEHYDROGENASES OF ATLANTIC HAGFISH: PHYSIOLOGICAL AND EVOLUTIONARY IMPLICATIONS OF A PRIMITIVE HEART ISOZYME. *Science* 207(4432):769-770. 15 Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Me., Orono 04469] Isozymes of lactate dehydrogenase from heart and muscle of Atlantic hagfish show less functional divergence than those from other fishes and higher vertebrates. The enzyme from hagfish heart

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80-001149 CONTINUED (B_4) displays a higher Michaelis constant for pyruvate and lower substrate inhibition at moderate pyruvate concentrations than heart isozymes from other species. These properties support the hypothesis that the ancestral vertebrate lactate dehydrogenase was a muscle (A_4)-type enzyme and also suggest a role for the B_4 enzyme in the unusual physiology of hagfish cardiac tissue which functions under sustained hypoxic conditions.

80-001150 Sidell, B. D.; R. G. Otto; D. A. Powers; M. Karweit and J. Smith. APPARENT GENETIC HOMOGENEITY OF SPAWNING STRIPED BASS IN THE UPPER CHESAPEAKE BAY. *Trans. Am. Fish. Soc.* 109(1):99-107. Jan. 1980. SFA 25(2)
[Dep. Zool., Univ. Me., Orono 04469]

80-001151 Smirnov, A. I. THE VARIABILITY OF THE BLACK SEA-AZOV TOAD-GOBY, *MESOGOBIUS BATRACHOCEPHALUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1010-1013. 1978. SFA 25(2)
[Zool. Inst., Ukrainian SSR Acad. Sci., Kiev, USSR]

80-001152 Thorgaard, G. H. and G. A. E. Gall. ADULT TRIPLOIDS IN A RAINBOW TROUT FAMILY. *Genetics* 93(4):961-973. Dec. 1979. SFA 25(2)
[Prog. Genet., Wash. State Univ., Pullman 99164] Six triploid individuals were found in a full-sib family of 11 adult rainbow trout (*Salmo gairdneri*) from a domesticated hatchery stock. The triploid individuals were normal in size and external appearance, had underdeveloped gonads, and showed no evidence of 3n/2n chimerism or mosaicism. *XXY* triploids were males, suggesting that the *Y* chromosome is male determining in trout. Because they may avoid production losses associated with sexual maturation in normal fish, triploid trout and salmon could potentially be useful in fish culture.

80-001153 Ueno, K.; S. Iwai and Y. Ojima. [KARYOTYPES AND GEOGRAPHICAL DISTRIBUTION IN THE GENUS *COBITIS* (COBITIDAE).] *Bull. Jpn. Soc. Sci. Fish.* 46(1):9-18. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Dep. Fish., Fac. Agric., Kinki Univ., Higashi-Osaka 557, Japan] Karyotypes of three spinous loaches, *Cobitis biwae*, *C. taenia taenia* and *C. taenia striata* from western Japan were investigated. As the result, chromosome polymorphisms and polyploid (tetraploid) were observed in these species. (1) *C. biwae*: Diploid specimens showed 48 chromosones in 2n number. There were three types in chromosome constitutions such as 22M+20SM, ST+6A, 20M+20SM, ST+8A and 20m+18SM, ST+10A. On the other hand, tetraploid specimens were characterized by 96 chromosones which consisted of 38M+54SM, ST+20A. (2) *C. taenia taenia*: Diploid specimens with 50 chromosomes were characterized by 12M+4SM+34A. In the tetraploid forms, two types of individuals with 86 and 94 chromosome numbers were found. These complements were made up of 32M+32SM, ST+22A in the former, and 26M+32SM, ST+36A in the latter. (3) *C. taenia striata*: Diploid form was the same as that of *C. taenia taenia*, whereas tetraploid form possessed 98 chromosomes consisting of 20M+22SM, ST+56A. (4) The geographical distribution on each group with different karyotypes showed that they have their own habitats forming respective isolated associations. Systematics and speciation in three species of Cobitidae were discussed on the bases of the karyotypic differentiation and habitat segregation.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001154 Varma, A. K. and J. S. Frankel. A COMPARISON OF TISSUE ESTERASES IN THE GENUS *BARBUS* BY VERTICAL GEL ELECTROPHORESIS. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):267-273. 1980. SFA 25(2)
[J. S. Frankel: Dep. Zool., Harvard Univ., Washington, DC 20059]

80-001155 Vladimirov, M. Z. EARLY POSTEMBRYONIC DEVELOPMENT AND MORPHOLOGY OF A NEW INTERGENERIC CYPRINID HYBRID (*RUTILUS FRISII* FEMALE X *VIMBA VIMBA VIMBA* MALE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):859-862. 1978. SFA 25(2)
[Inst. Exp. Zool. Physiol., Moldavian Acad. Sci., Kishinev, USSR]

80-001156 Yelenc, J. G. INVESTIGATION OF CHROMOSOME BANDING TECHNIQUES AND OF PSEUDOLINKAGE IN *SALVELINUS* SPECIES. *Ph.D. dissertation, Pa. State Univ.* 152p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4092. Mar. 1980. SFA 25(2)

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80-001157 Ali, M. A. and G. E. Pickford. THE EFFECTS OF HYPOPHYSECTOMY ON THE RETINOMOTOR RESPONSES OF THE KILLIFISH, *FUNDULUS HETEROCLITUS*. *Rev. Can. Biol.* 38(3):139-144. Sept. 1979. In English with French summ. SFA 25(2)
[Dep. Biol., Univ. Montreal, PQ H3C 3J7, Canada]

80-001158 Anonymous. RARE SHARK ATTACK MARS COASTAL SURFING. *Oreg. Wildl.* 35(1):12-13. Jan. 1980. SFA 25(2)

80-001159 Ashmore, J. F. and G. Falk. THE SINGLE-PHOTON SIGNAL IN ROD BIPOLAR CELLS OF THE DOGFISH RETINA. *J. Physiol. (Lond.)* 300:151-166. Mar. 1980. SFA 25(2)
[Dep. Ophthalmol., Univ. Calif., San Francisco 94143]

80-001160 Ashmore, J. F. and G. Falk. RESPONSES OF ROD BIPOLAR CELLS IN THE DARK-ADAPTED RETINA OF THE DOGFISH, *SCYLIORHINUS CANICULA*. *J. Physiol. (Lond.)* 300:115-150. Mar. 1980. SFA 25(2)
[Dep. Ophthalmol., Univ. Calif., San Francisco 94143]

80-001161 Bols, R. J. and J. A. Hogan. RUNWAY BEHAVIOR OF SIAMESE FIGHTING FISH, *BETTA SPLENDENS*, FOR AGGRESSIVE DISPLAY AND FOOD REINFORCEMENT. *Anim. Learn. Behav.* 7(4):537-542. Nov. 1979. SFA 25(2)
[Univ. Toronto, Toronto, ON M5S 1A1, Canada]

80-001162 Bowmaker, J. K. VISUAL PIGMENT ABSORBANCE AND SCOTOPIC SPECTRAL SENSITIVITY IN THE GOLDFISH, *CARASSIUS AURATUS*. *Rev. Can. Biol.* 38(3):185-187. Sept. 1979. In English with French summ. SFA 25(2)
[Dep. Zool. Comp. Physiol., Queen Mary Coll., Mile End Rd., London E1 4NS, England]

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80-001163 Chauvin-Muckensturm, B. LE PROBLÈME DE LA FIXATION GÉNOTYPIQUE DU COMPORTEMENT AGRESSIF CHEZ LES ÉPINOCHES (*GASTEROSTEUS ACULEATUS* L.). [IS THERE A GENOTYPIC FIXATION OF AGGRESSIVE BEHAVIOUR IN THREE SPINED STICKLEBACK.] *C.R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 289(13):935-938. 19 Nov. 1979. In French with English summ. SFA 25(2)
[Univ. René-Descartes, Lab. Sociol. Anim., Château d'Ivoy-le-Pré, 18380 La-Chapelle-Angillon, France] There is no evidence of a genotype fixation of the raction to red belly models in naive three spined Sticklebacks.

80-001164 Coutant, C. C. and D. S. Carroll. TEMPERATURES OCCUPIED BY TEN ULTRASONIC-TAGGED STRIPED BASS IN FRESHWATER LAKES. *Trans. Am. Fish. Soc.* 109(2):195-202. Mar. 1980. SFA 25(2)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

80-001165 deMond, D. K. BEHAVIORAL THERMOREGULATION OF THE BLUEGILL, *LEPOMIS MACROCHIRUS*. *J. Miss. Acad. Sci.* 24(Suppl.):114. 1979. Abstract only. SFA 25(2)
[Dep. Biol., Univ. South. Miss., Hattiesburg 39401]

80-001166 Eberhart, A. C. THE SOUND PRODUCING MECHANISMS OF THE BROWN BULLHEAD, *ICTALURUS NEBULOSUS*. *M.A. thesis, Calif. State Univ. (Long Beach)* 39p. 1979. From Masters Abstr. 17(4):295. Dec. 1979. SFA 25(2)
The brown bullhead, *Ictalurus nebulosus*, is a catfish that typically inhabits low elevation lakes throughout much of North America. This paper describes the sounds of the brown bullhead and the mechanisms by which these sounds are produced. Grunting sounds with a frequency of 50-400 Hz and a duration of 0.25 s are produced by vibration of the swim bladder. The mechanism of swim bladder vibration involves the posterior rami of the fourth vertebral parapophyses and their associated fast-acting muscles, and is unique to any described previously. Clicking sounds are also produced, which have a duration of 0.1 s at 250 Hz and a shorter duration at frequencies between 250 and 2,500 Hz. The probable mechanism of these clicks involves contact between the more dorsal spine of the cleithrum and the anterior ramus of the fourth vertebral parapophysis (Mullerian ramus).

80-001167 Goodyear, C. P. and D. H. Bennett. SUN COMPASS ORIENTATION OF IMMATURE BLUEGILL. *Trans. Am. Fish. Soc.* 108(6):555-559. Nov. 1979. SFA 25(2)
[U.S. FWS, 2929 Plymouth Rd., Room 206, Ann Arbor, MI 48105]

80-001168 Helfman, G. S. TEMPORAL RELATIONSHIPS IN A FRESHWATER FISH COMMUNITY. *Ph. D. dissertation, Cornell Univ.* 279p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2504. Dec. 1979. SFA 25(2)

80-001169 Hesthagen, I. H. LOCOMOTOR ACTIVITY IN THE PAINTED GOBY, *POMATOSCHISTUS PICTUS* (MALM) (PISCES), IN RELATION TO LIGHT INTENSITY. *Sarsia* 65(1):13-18. 1980. SFA 25(2)
[Inst. Marinbiol. Limnol., Univ. Oslo, P.B. 1064 Blindern, Oslo 3, Norway]

80-001170 Hogan, J. A. and R. J. Bols. PRIMING OF AGGRESSIVE MOTIVATION IN *Betta splendens*. *Anim. Behav. (Baillière Tindall, Publ.)* 28(1):135-142. Feb. 1980. SFA 25(2)
[Dep. Psychol., Univ. Tortoto, Toronto, ON M5S 1A1, Canada] Swimming speed in a runway for a view of a conspecific was shown to be positively correlated with vigour of aggressive display prior to the experiment. A

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80-001170 CONTINUED priming procedure (pre-exposure to a conspecific), and decreasing the time between trials, were then shown to increase swimming speed. Priming also increased the choice for a conspecific over food, but only in the presence of particular external stimuli. These results are interpreted to mean that the level of aggressive motivation is determined by a complex interaction of internal and external factors, and that there is a high degree of similarity between aggression and other motivations such as hunger and thirst.

80-001171 Inoue, M.; T. Arimoto and I. Kono. [DEGREE OF DISPERSION OF THE *ZACO TEMMINCKI* SCHOOL TO WATER QUALITY IN A STREAMING WATER TROUGH.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1485-1490. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Tokyo Univ. Fish., Konan, Minato-ku, Tokyo 108, Japan]

80-001172 Iwasaki, Y. [A STUDY ON THE BODY SIZE COMPOSITION OF YELLOWFIN TUNA AND SKIPJACK SHOALS CAUGHT BY PURSE SEINES.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):19-25. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Fac. Mar. Sci. Technol., Tokai Univ., Shimizu 424, Japan]

80-001173 Kabayama, A.; G. Kawamura and T. Yonemori. THE AXIS OF HORIZONTAL EYE ROTATION OF FISH. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1481-1483. Dec. 1979. SFA 25(2)
[Nippon Oceanic Survey Co. Ltd., Minato 7-8, Moji, Kitakyushu 801, Japan]

80-001174 Kavaliers, M. SOCIAL GROUPINGS AND CIRCADIAN ACTIVITY OF THE KILLIFISH, *FUNDULUS HETEROCLITUS*. *Biol. Bull.* (*Woods Hole*) 158(1):69-76. Feb. 1980. SFA 25(2)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523]

80-001175 Kawamura, G. [FUNDAMENTAL STUDY ON APPLICATION OF THE VISION OF SPOTTED MACKEREL, *PNEUMATOPHORUS TAPEINOCEPHALUS* (BLEEKER), TO ANGLING TECHNIQUES--VI. MOVEMENT OF FISH SCHOOL ATTRACTED TO FISH LAMP ESTIMATED FROM THE TIME SERIES OF CATCH]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1241-1247. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Technol., Fac. Fish., Kagoshima Univ., Kagoshima, Japan]

80-001176 Kawamura, G. [FUNDAMENTAL STUDY ON APPLICATION OF THE VISION OF SPOTTED MACKEREL, *PNEUMATOPHORUS TAPEINOCEPHALUS* (BLEEKER), TO ANGLING TECHNIQUES--V. DISCUSSION ON THE LIGHT INTENSITY OF FISH LAMP]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1237-1240. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Technol., Fac. Fish., Kagoshima Univ., Kagoshima, Japan]

80-001177 Kawamura, G. and A. Kabayama. HORIZONTAL COMPENSATORY EYE MOVEMENTS IN SWIMMING FISHES. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1359-1364. Nov. 1979. SFA 25(2)
[Lab. Fish. Technol., Fac. Fish., Kagoshima Univ., Kagoshima, 890 Japan]

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80-001178 Kerr, S. R. and E. E. Werner. NICHE THEORY IN FISHERIES ECOLOGY. *Trans. Am. Fish. Soc.* 109(2):254-260. Mar. 1980. SFA 25(2)
[Dep. Fish. Oceans, Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth NS B2Y 4A2, Canada]

80-001179 Kingston, D. I. EYE-COLOR CHANGES DURING AGGRESSIVE DISPLAYS IN THE GOODEID FISHES. *Copeia* 1980(1):169-171. 1 Feb. 1980. SFA 25(2)
[Fish Div., Mus. Zool., Univ. Mich., Ann Arbor 48109]

80-001180 Konagaya, T. [JUMPING RESPONSE OF AYU TO SOUND.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):31-34. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Fac. Fish., Mie Univ., Edobashi, Tsu 514, Japan] While ascending streams from the sea to the upper river, the fry of ayu (*plecoglossus altivelis*) has a strong anadromous character and shows jumping response not only to water falls but also to underwater sound. Generally, the auditory sensitivity of fish has been studied with electrophysiological or psychophysical experiments. It may also be possible to study it by the behavioral observation of the jumping response of the fish to underwater sound. From these observations, the following results were obtained: The most sensitive frequency of the fish to underwater sound was about 200 Hz. However, the sensitivity of the fish was not clear above 600 Hz. The lowest threshold level of underwater sound for jumping response was 72 dB (re 1 µPa) at a frequency of 200 Hz. The numbers of fish responding to the sound pressure were distributed following a normal curve in the range of 70 to 80 dB (re 1 µPa).

80-001181 Krassenstein, R. C. HABITAT SELECTIVITY OF TROUT-PERCH LARVAE IN THE CONNEAUT HARBOR AREA OF LAKE ERIE. *Ohio J. Sci.* 80:13. 1980. Abstract only. SFA 25(2)
[Dep. Biol., John Carroll Univ., Cleveland, OH 44118] Larval Trout-perch (*Percopsis omiscomaycus*) were collected by standard replicate ichthyoplankton tows at six sites in and near the Conneaut Harbor between 1 May and 15 August, 1978. Sample sites were chosen to include two "protected" areas immediately inside the breakwalls, two "unprotected" areas immediately outside these walls in Lake Erie, a location in the open-water area of mid-harbor and a beach area just west of the harbor. In all areas the frequency of Trout-perch larval forms increased through the month of May, peaked in mid-June and declined thereafter. Throughout the sampling period, sites offering protection from wave action produced higher numbers of larvae per cubic meter of water than all other sites. Open lake sites near the breakwalls and at the beach yielded moderate numbers of larvae while the site in mid-harbor exhibited the fewest larvae. These data suggest that artificially created areas of protected waters may be an extremely important factor in the production of Trout-perch in the Central Basin of Lake Erie, and further that breakwalls in general may serve as acceptable and perhaps equivalent areas of production when compared to available beach spawning areas.

80-001182 Kratochvil, H. GESCHLECHTSDIMORPHISMUS BEIM LAUTAPPARAT DES KNURRENDEN ZWERGGURAMI *TRICHOPSIS PUMILUS* ARNOLD (ANABANTIDAE, TELEOSTEI). [SEXUAL DIMORPHISM OF THE SOUND PRODUCING ORGAN IN THE PYGMY GOURAMI (*TRICHOPSIS PUMILUS* ARNOLD) (ANABANTIDAE, BELONTIIDAE).] *Zoomorphologie* 94(2):203-208. 1980. In German with English summ. SFA 25(2)
[Zool. Inst. Univ. Vienna, Dr. Karl Leuger-Ring 3, A-1010 Vienna, Austria]

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80-001183 Lapkins, V. V.; A. M. Svirski and Yu. N. Sopov. SELECTED AND ACCLIMATION TEMPERATURES IN FISHES. *Zool. Zh.* 58(11):1659-1670. Nov. 1979. In Russian with English summ. SFA 25(2)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Dist., USSR]

80-001184 Laughlin, D. R. RESOURCE AND HABITAT USE PATTERNS IN TWO COEXISTING SUNFISH SPECIES (*LEPOMIS GIBBOSUS* AND *LEPOMIS MEGALOTIS PELTASTES*). *Ph.D. dissertation, Mich. State Univ.* 102p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(7):3041. Jan. 1980. SFA 25(2)
Habitat partitioning is the principal means of interspecific coexistence in small soft-bottomed lakes in Michigan. The northern longear and pumpkinseed sunfishes are both morphologically similar and apparently adapted for benthic foraging. Clear spatial segregation was observed in preliminary studies. The sympatric distribution of both species in 5 local lakes was quantified in relation to the structural habitat. Food utilization was examined with respect to prey type, size and microhabitat association. During mid-summer, the larger size-classes of each species used different foraging micro-habitats. Adult longears were specialized for foraging within marl sediments and are absent when this micro-habitat is not present. Their spatial distribution was largely dependent upon the arrangement of sediment micro-habitats within the environment. Pumpkinseeds were generally distributed, but were more closely associated with aquatic vegetation and prey, primarily hardshelled gastropods. Interspecific spatial overlap was negatively related to the degree of separation of foraging micro-habitats. The smaller size-classes exhibited greater food and spatial overlap, a pattern attributable to predation pressure. Greater interspecific food overlap also occurred during the spring. It is concluded that little competition exists at the present time between the longear and pumpkinseed. The longear is a habitat specialist that uses a distinctively different niche than the pumpkinseed. The present niche differences are attributable to the evolutionary environment of each species. A consideration of the sunfish community shows that morphological and behavioral traits are related to the ecological characteristics of the habitat and prey.--From abstr.

80-001185 Luoma, M. E. and J. H. Gee. SEASONAL FACTORS AFFECTING BUOYANCY ATTAINED IN STILL WATER AND CURRENT BY FATHEAD MINNOWS, *PIMEPHALES PROMELAS*. *Can. J. Fish. Aquatic Sci.* 37(4):670-678. Apr. 1980. SFA 25(2)
[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada]

80-001186 Madsen, L. SOCIAL SPACING IN NORTHERN GULF KILLIFISHES. *Proc. La. Acad. Sci.* 42:82. 1979. Abstract only. SFA 25(2)
[La. State Univ., Baton Rouge]

80-001187 Mathur, D. and C. A. Silver. STATISTICAL PROBLEMS IN STUDIES OF TEMPERATURE PREFERENCE OF FISHES. *Can. J. Fish. Aquatic Sci.* 37(4):733-737. Apr. 1980. SFA 25(2)
[Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518]

80-001188 Matthews, W. J. and L. G. Hill. HABITAT PARTITIONING IN THE FISH COMMUNITY OF A SOUTHWESTERN RIVER. *Southwest. Nat.* 25(1):51-66. 30 Jan. 1980. SFA 25(2)
[Biol. Stn., Univ. Okla., Norman 73019] Patterns of habitat partitioning and spatial overlap are documented for the fishes of an environmentally unstable southwestern river, *Notropis lutrensis* (red shiner), *Notropis girardi* (Arkansas River shiner), *Hybognathus placitus* (plains minnow), and *Gambusia affinis* (mosquitofish) numerically dominated the fish fauna; few centrarchids or other large species were present. While the dominant

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80-001188 CONTINUED species showed some spatial segregation at most times, their habitat use was transitory, changing as environmental conditions changed. The dominant species made wide use of the avilable habitat during mild environmental conditions and constricted habitat use when physico-chemical conditions were potentially stressful. Species associations were also transitory; no species pairs consistently exhibited strong spatial overlap. Habitat partitioning thus appears less structured in this stream than in more stable environments that have been studied. The fish fauna was characterized by ecologic plasticity, with the most successful species showing marked habitat flexibility.

80-001189 Mundry, P. R. A QUANTITATIVE MEASURE OF MIGRATORY TIMING ILLUSTRATED BY APPLICATION TO THE MANAGEMENT OF COMMERCIAL SALMON FISHERIES. *Ph. D. dissertation, Univ. Wash.* 94p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2563. Dec. 1979. SFA 25(2)

80-001190 Munson, B. H.; J. H. McCormick and H. L. Collins. INFLUENCE OF THERMAL CHALLENGE ON CONDITIONED FEEDING FORAYS OF JUVENILE RAINBOW TROUT. *Trans. Am. Fish. Soc.* 109(1):116-121. Jan. 1980. SFA 25(2)
[U.S. Environ. Prot. Agency, Environ. Res. Lab., 6201 Congdon Blvd., Duluth, MN 55804]

80-001191 North, E. AGGRESSIVE BEHAVIOUR OF JUVENILE BROWN TROUT *SALMO TRUTTA*, L: AN ANALYSIS OF THE WIGWAG DISPLAY. *J. Fish Biol.* 15(5):571-577. Nov. 1979. SFA 25(2)
[Area Fish. Off., Severn-Trent Water Auth., 64 Albert Rd. North, Malvern, Worc's. WR14 1BR, England] The wigwag display of the juvenile brown trout (*Salmo trutta*, L) was analysed and found to be a ritualised display used specifically as a defensive manoeuvre in the aggressive interactions of groups of fish. Wigwag displays performed against fish of lower or equal social rank were highly effective as a defence but wigwags performed against higher ranking fish were less than 50% effective.

80-001192 Partridge, B. L. THE EFFECT OF SCHOOL SIZE ON THE STRUCTURE AND DYNAMICS OF MINNOW SCHOOLS. *Anim. Behav. (Baillière Tindall, Publ.)* 28(1):68-77. Feb. 1980. SFA 25(2)
[Lab. Quant. Biol., Dep. Biol., Univ. Miami, Coral Gables, FL 33124] Varying the number of fish in schools of minnows (*Phoxinus phoxinus*) affects their three-dimensional structure and internal dynamics. Previous authors have suggested that single pairs of fish can be considered a school, but internal organization and structure of two-fish schools are quantitatively different from those for larger schools. Time series analyses show that correlations between fishes instantaneous velocities increase with school size and as interfish distances decrease. Average cross-correlations of fishes' velocities indicate that leader/follower relationships are common in two-fish schools, but they are not seen for schools with more fish in them. Pairs of fish tend to swim one behind another and on the same level, but larger schools take on a more three-dimensional appearance.

80-001193 Partridge, B. L. and T. J. Pitcher. THE SENSORY BASIS OF FISH SCHOOLS: RELATIVE ROLES OF LATERAL LINE AND VISION. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 135(4):315-325. Feb. 1980. SFA 25(2)
[Dep. Biol., Univ. Miami, Coral Gables, FL 33124]

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80-001194 Parzefall, J. ZUR GENETIK UND BIOLOGISCHEN BEDEUTUNG DES AGGRESSIONSVERHALTENS VON *POECILIA SPHENOPS* (PISCES, POECILIIDAE). UNTERSUCHUNGEN AN BASTARDEN OBER-UND UNTERIRDISCH LEBENDER POPULATIONEN. [AGGRESSIVE BEHAVIOUR OF *POECILIA SPHENOPS* (PISCES, POECILIIDAE). STUDIES ON HYBRIDS OF EPIGIOUS AND HYPOGEOUS LIVING POPULATIONS.] *J. Comp. Ethol.* 50(4):399-422. Aug. 1979. SFA 25(2)

[Mus. Univ. Hamburg, Hamburg, West Germany] The aggressive behaviour of hybrids between an epigeous and a cave-dwelling form of the toothcarp *Poecilia sphenops* was investigated in order to test whether a gentically determined reduction of aggressive behaviour exists in the cave population. The scores for five different elements of this behaviour as well as for the duration of fights support this hypothesis and suggest that aggressive behaviour in *Poecilia sphenops* is controlled by a closely linked polygenetic system. On the basis of laboratory and field investigations, to aggressive behaviour is attributed the function of giving large males a reproductive advanage within the framework of a body-size dependent rank order. Small males appear to counteract this one-sided selective advantage through a special strategy of sexual behaviour.

80-001195 Pavlov, D. S. and Yu. N. Sbikin. THE NUMBER OF VISUAL REFERENCE POINTS AND INFLUENCE ON THE MANIFESTATION OF RHEOREACTION IN FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1022-1026. 1978. SFA 25(2)

[IEMEZh, USSR Acad. Sci., Moscow, USSR]

80-001196 Pottle, R. A. and J. M. Green. TERRITORIAL BEHAVIOUR OF THE NORTH TEMPERATE LABRID, *TAUTOGOLABRUS ADSPERSUS*. *Can. J. Zool.* 57(12):2327-2347. Dec. 1979. In English with French summ. SFA 25(2)

[J. M. Green: Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1B 3X9, Canada] A study of territorial behaviour of the cunner, *Tautogolabrus adspersus*, was carried out in Conception Bay, Newfoundland, in 1977 and 1978. Cunners that overwinter in a torpid state were active only from May to late October of both years. Large males established territories prior to the midsummer spawning season and territories were defended throughout and after that season. Territory size ranged from 16.1 to 74.3 m^2 on rocky substrate at depths of 0.7 to 13 m and did not vary significantly with either the size of the resident fish or the degree of intraspecific aggression it exhibited. Nonterritorial males were generally smaller than territorial males and were vigorouly excluded from their territories. Only territorial males exhibited interspecific aggression, which was most frequent toward *Pholis gunnellus*. Territorial females were present in the peripheral areas of some males' territories and were aggressive toward other females. Tagging indicated that most males and some females defend the same territory from year to year, and that territory size remains relatively constant. The proportions of territorial and nonterritorial fish, of either sex, in the population are unknown. The primary function of territorial behaviour in *T. adspersus* may be the provision of a spawning site from which potential rivals are excluded.

80-001197 Reynolds, W. W. and M. E. Casterlin. BEHAVIORAL THERMOREGULATION AND LOCOMOTOR ACTIVITY OF *PERCA FLAVESCENS*. *Can. J. Zool.* 57(11):2239-2242. Nov. 1979. In English with French summ. SFA 25(2)

[Cent. Life Sci., Univ. New England, Biddeford, ME 04005] Ten yearling yellow perch (*Perca flavescens*) were tested individually for 3-day periods in electronic shuttleboxes to determine their diel patterns of behavioral thermoregulation and of locomotor activity relative to a natural April photoperiod, and to determine the relationship between preferred temperatures and activity. The perch exhibited a diel rhythm of preferred temperature, with a predawn minimum of 16.7°C and a dusk maximum of 23.8°C. The 24-h mean was 20.2°C; the diurnal mean was 21.5°C and the nocturnal mean was 18.5°C. Locomotor activity (quantified as mean

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80-001197 CONTINUED photocell-monitored light-beam interruptions per hour) was crepuscular, with a major peak (25 units/h) at dusk, and a smaller peak (14.4 units/h) at dawn. Nocturnal activity was slightly greater (5.3 units/h) than diurnal activity (4.4 units/h). Locomotor activity relative to temperature exhibited a local minimum (0.4-6.2 units/h) at 22.2°C.

80-001198 Sazima, I. and V. S. Uieda. IS THE NIGHT-TIME RESTING BEHAVIOR OF YOUNG NEEDLEFISH AN EXAMPLE OF NOCTURNAL DISGUISE? *Biotropica* 11(4):308-309. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Estradual Campinas, 13100 Campinas, São Paulo, Brazil]

80-001199 Sazima, I. BEHAVIOR OF TWO BRAZILIAN SPECIES OF PARODONTID FISHES, *APAREIODON PIRACICABAE* AND *A. IBITIENSIS*. *Copeia* 1980(1):166-169. 1 Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Estud. Campinas, 13 100 Campinas São Paulo, Brazil]

80-001200 Stascheit, M. TEMPERATURE DEPENDENCE OF MEMORY IN FISH. *J. Comp. Ethol.* 51(2):140-152. Oct. 1979. SFA 25(2)
[Zool. Inst., Univ. Münster, Abt. Verhaltensforsch., Bodestraße 9, D-4400 Münster, West Germany] The influence of temperature on the retention period of a pattern discrimination task (cross versus triangle) was examined on *Carassius carassius*, *Cichlasoma nigrofaciatum* and *Phoxinus phoxinus*. After training at optimal temperature conditions the experimental subjects were kept at a 10°C lowered temperature, whereas for control subjects there was no temperature change. Tests, carried out every two weeks, showed a significant increase of retention for *Carassius c.* and *Cichlasoma n.*; *phoxinus p.* showed a slightly more rapid forgetting. These results and investigations of oxygen-uptake indicate a direct dependence of memory processes on the metabolic level.

80-001201 Stevens, E. D. THE EFFECT OF TEMPERATURE ON TAIL BEAT FREQUENCY OF FISH SWIMMING AT CONSTANT VELOCITY. *Can. J. Zool.* 57(8):1628-1635. Aug. 1979. In English with French summ. SFA 25(2)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Rainbow trout and largemouth bass were swum at fixed swim speeds from one to three body lengths per second at ambient water temperatures from 5 to 35°C. Tail beat frequency was measured during steady swimming. Both tail beat frequency and stride length (distance moved per tail beat) increased with increased swim speed. In trout tail beat frequency was lower at higher water temperatures, whereas in bass tail beat frequency was higher at higher water temperatures. In both trout and bass tail beat frequency was lower in fish acclimated to a higher temperature. I suggest that when test temperature is above acclimation temperature the muscle operates high on the force-velocity curve; and when test temperature is below acclimation temperature the muscle operates low on the force-velocity curve.

80-001202 Takamura, K. [UTILIZATION OF HABITAT BY YOUNG PALE CHUB, *ZACCO PLATYPUS* (TEMMINCK ET SCHLEGEL) (PISCES: CYPRINIDAE)]. *Jpn. J. Ecol.* 29(3):295-306. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Dep. Zool., Fac. Sci., Kyoto Univ., Kyoto 606, Japan]

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80-001203 Webb, P. W. DOES SCHOOLING REDUCE FAST-START RESPONSE LATENCIES IN TELEOSTS? *Comp. Biochem. Physiol. A Comp. Physiol.* 65(2):231-234. 1980. SFA 25(2)

[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Response latencies, defined as the time between a d.c. electric shock and initiation of a fast-start (startle response) were measured for eight species of teleosts. Fast-start response latencies varied from 10 to 36 cm. Highest values were found for individuals of two solitary species, *Etheostoma caeruleum* and *Cottus cognatus*. Lowest values were found for *Esox* and *Salmo gairdneri*. Schooling in *Perca flavescens*, *Lepomis macrochirus* and *Pimephales promelas* significantly reduced fast-start response latencies by 7-16 msec. A 4 msec. reduction for *Notropis cornutus* was not significant. No reduction in fast-start response latency was found for *Pimephales promelas* given the illusion of a school or for individuals greater than 15 cm from a school. The observed variation in fast-start response latency would favour attack success of predators and escape success for schooled, but not solitary, presumptive prey.

LIFE HISTORY-GENERAL WORKS

80-001204 Capapé, C. LA TORPILLE MARBRÉE, *TORPEDO MARMORATA* RISSO, 1810 (PISCES, RAJIFORMES) DES CÔTES TUNISIENNES: NOUVELLES DONNÉES SUR L'ÉCOLOGIE ET LA BIOLOGIE DE LA REPRODUCTION DE L'ESPÈCE, AVEC UNE COMPARAISON ENTRE LES POPULATIONS MÉDITERRANÉENNES ET ATLANTIQUES. [THE MARBLE RAY, *TORPEDO MARMORATA* RISSO 1810 (PISCES, RAJIFORMES) OF THE TUNISIAN COASTS: NEW DATA ON ECOLOGY AND BIOLOGY OF REPRODUCTION OF THE SPECIES WITH A COMPARISON BETWEEN MEDITERRANEAN AND ATLANTIC POPULATIONS.] *Ann. Sci. Nat. (Zool.) 13 Ser.* 1(2):79-97. Apr.-June 1979. In French with English summ. SFA 25(2)

[Inst. Pasteur, Tunis, Tunisia]

80-001205 Beecher, H. A. COMPARATIVE FUNCTIONAL MORPHOLOGY AND ECOLOGICAL ISOLATING MECHANISMS IN SYMPATRIC FISHES OF THE GENUS *CARPIODES* IN NORTHWESTERN FLORIDA. *Ph. D. dissertation, Fla. State Univ.* 219p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2557. Dec. 1979. SFA 25(2)

80-001206 Brandt, S. B. THERMAL ECOLOGY AND ABUNDANCE OF ALEWIFE (*ALOSA PSEUDOHARENGUS*) IN LAKE MICHIGAN. *Ph.D. dissertation, Univ. Wis.* 248p. 1978. From Diss. Abstr. Int. B Sci. Eng. 40(6):2479. Dec. 1979. SFA 25(2)

The purpose of this research was to examine abundance, vertical distribution, resource utilization, and thermal ecology of alewife in Lake Michigan. Both *Mysis* and adult alewife concentrated near the bottom during day and migrated up to the thermocline at night. The extent and rates of vertical migrations by *Mysis* and alewife coincided. At night adult alewife fed extensively on *Mysis*. *Mysis* in alewife stomachs were larger than those captured in vertical plankton tows. *Pontoporeia hoyi* were present in a higher proportion of alewife stomachs in late afternoon during September and early evening in June and October than during night and morning. Microcrustacean zooplankton were eaten mostly during day in June or early morning in October rather than at night. During the day young of the year (YOY) alewife concentrated at epilimnial temperatures of 17-19 C and adults inhabited thermocline temperatures of 11-14 C. Bathymetric distributions shifted in response to inshore-offshore movements of the position of the intersection of the thermocline with the bottom. Both adults and YOY apparently migrated into midwater at night. Calanoid copepods, cyclopoid copepods and *Daphnia* sp. were numerically dominant in YOY alewife diet and were eaten primarily during the day. Adult alewife fed on

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80-001206 CONTINUED microcrustacean zooplankton, *Mysis* and *Pontoporeia*. *Daphnia* sp. were numerically the most abundant prey and more were eaten during the day than at night. Observed distributions stress the importance of thermal structure, food abundance, and potential intraspecific and interspecific interactions. Results on distribution were used to determine sampling design and data stratification for an acoustic estimate of total alewife abundance in the southern basin of Lake Michigan. From October 16-28, 1976, estimated fish densities ranged from 0 to approximately .058 fish/m^3. Mean densities within temperature, depth and geographic strata were .0009 to .00131 fish/m^3. Fish density increased in the thermocline, particularly near the intersection of the thermocline with the bottom. The total number of pelagic fish in the southern basin was estimated at 4.9735 ± .3952 x 10^8. Assuming that all fish were alewife and that mean alewife weight was 42.9, then the total biomass was 21,336 metric tons. Day bottom trawl catches were 3.6-14.1% of that predicted acoustically.--From abstr.

80-001207 Case, G. R.; V. R. Koestler and R. J. Koestler. THE SHORTCHANGED SHARK. *Underwater Nat.* 12(2):10-14. 1980. SFA 25(2)

80-001208 Clay, D. POPULATION BIOLOGY, GROWTH AND FEEDING OF AFRICAN CATFISH (*CLARIAS GARIEPINUS*) WITH SPECIAL REFERENCE TO JUVENILES AND THEIR IMPORTANCE IN FISH CULTURE. *Arch. Hydrobiol.* 87(4):453-482. 1979. SFA 25(2)

[Dep. Agric., Univ. Rhodesia, Salisbury, Rhodesia] Length-frequency analysis of juvenile *Clarias gariepinus*, from Lake McIlwaine, Rhodesia, indicates that they carried out multiple spawning in 1974 and 1975. Temperature preference was found to be 32.7±1.5°C. Preferred temperature may be actively sought by the juveniles who remain in the shallows until 15 to 22 cm. Recruitment from the shallows to the offshore population occurs between about 15 to 22 cm. The smallest ripe male was 25 cm and ripe female was 28 cm. As it has been noted that sex may be identified internally on fish over 13 cm, it may be that recruitment to the adult population is a function of sexual development and feeding biology, both of which are governed by temperature. Growth was estimated to be 15 cm in the first 6 months (warm water period), slowing to a total of only 18 to 20 cm in 9 months (which includes the cold water period). A change in the length-mass relationship occurs at 10 cm. This is probably another indication that sexual maturity occurs around 10 to 14 cm. Fish of 4 to 10 cm give the length-mass relationship $Y = 3.623 \times 1/10^4 X^{2.09}$ and fish 10 to 34 cm give the relationship $Y = 2.834 \times 1/10^6 X^{3.18}$ where Y is the mass in grams and X is the total length in millimetres. Catfish were found to be opportunistic feeders, varying their food according to availability. Maximum prey size bears a straight line relationship to fish length. Juvenile catfish are recommended as a suitable fish for tropical aquaculture because they can survive low dissolved oxygen levels, can be marketed live, can withstand high diurnal temperature fluctuations, prefer very warm water, are able to utilize various trophic levels in a pond, and have rapid growth allowing a skimming type harvest.

80-001209 Copes, F. A. ECOLOGY OF THE BRASSY MINNOW *HYBOGNATHUS HANKINSONI* (CYPRINIDAE). *Mus. Nat. Hist. Univ. Wis. (Stevens Point) Rep. Fauna Flora Wis.* No. 10(part 3). p. 47-72. 1975. SFA 25(2)

[Dep. Biol., Univ. Wis., Stevens Point 54481]

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80-001210 Copes, F. C. ECOLOGY OF THE CREEK CHUB. *Mus. Nat. Hist. Univ. Wis. (Stevens Point) Rep. Fauna Flora Wis.* No. 12. 21p. 30 Apr. 1978. SFA 25(2)
[Dep. Biol., Univ. Wis., Stevens Point 54481]

80-001211 Dadswell, M. J. BIOLOGY AND POPULATION CHARACTERISTICS OF THE SHORTNOSE STURGEON, *ACIPENSER BREVIROSTRUN* LESUEUR 1818 (OSTEICHTHYES: ACIPENSERIDAE), IN THE SAINT JOHN RIVER ESTUARY, NEW BRUNSWICK, CANADA. *Can. J. Zool.* 57(11):2186-2210. Nov. 1979. In English with French summ. SFA 25(2)
[Fish. Oceans Can., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] During a 4-year study, 4178 shortnose sturgeon were captured and 2453 marked with numbered tags and released. For adults, Z was estimated as 0.12-0.15 and F was estimated as 0.01. The population weight-length relationship was log W = 3.21(log FL) - 5.45, where W = weight in kilograms and FL = fork length in cm. The oldest female was 67 years; the oldest male was 32 years. Von Bertalanffy growth parameters L_∞, W_∞, and K were 127.0 cm, 24.8 kg, and 0.047 for females, and 108.7 cm, 13.9 kg, and 0.063 for males. Sex ratio of adults was 2:1 for females. Males spawned first about age 12 and probably at 2-year intervals thereafter; females spawned at 18 years and 3- to 5-year intervals thereafter. Fecundity was 27,000-208,000 eggs per female. Spawning occurs in freshwater, riverine sections of the upper estuary during May-June at 10-15°C. Feeding occurred only during May to October in fresh water but continued all year in saline water. Juveniles ate mainly insects and crustaceans; adults ate small molluscs. Juveniles remained in fresh water until they attained 45 cm, then joined the regular annual migration of adults, which moved upstream in spring-summer and seaward in fall. Many ripening females migrated upstream in fall and overwintered in deep, freshwater sites adjacent to spawning grounds. The Seber-Jolly estimate of the adult (>50 cm) population was 18,000 ± 30%.

80-001212 Dauble, D. D. LIFE HISTORY OF THE BRIDGELIP SUCKER IN THE CENTRAL COLUMBIA RIVER. *Trans. Am. Fish. Soc.* 109(1):92-98. Jan. 1980. SFA 25(2)
[Freshwater Sci., Ecosyst. Dep., Battelle, Pac. Northwest Lab., Richland, WA 99352]

80-001213 Dees, L. T. SEA LAMPREY. *U.S. Fish Wildl. Serv. Great Lakes Fish. Lab. Contrib.* 546. 7p. 1980. SFA 25(2)
[838 W. Woodrow, Arlington, VA]

80-001214 Dewberry, T. C. SOME ASPECTS OF THE POPULATION ECOLOGY OF THE SMALLMOUTH BASS IN A SMALL MICHIGAN STREAM. *M.S. thesis, Mich. State Univ.* 75p. 1978. From Masters Abstr. 17(4):246. Dec. 1979. SFA 25(2)
The population of large smallmouth bass appeared to vary greatly throughout the year in Spring Brook. THe most plausible explanation was that the fish were migratory. Mark-and-recapture electrofishing inventories were conducted in April, June, and September. A weir with two-way fish traps was maintained from April into September. The data indicated the large smallmouth bass were not migratory. They did move considerably during the year but movement was generally limited to about 1 km. Analysis of their habitat requirements provided an explanation for the movement. An investigation of the geology and hydrology of the drainage basin provided an explanation for the distribution of smallmouth bass in Spring Brook. The size of crayfish eaten by the rockbass and smallmouth bass, combined with field observations, suggested that Age-I and II smallmouth bass fed primarily in riffles; while the rockbass predominantly fed in the vegetational areas along the stream margin.

LIFE HISTORY-GENERAL WORKS

80-001215 Eldon, G. A. BREEDING, GROWTH, AND AESTIVATION OF THE CANTERBURY MUDFISH, *NEOCHANNA BURROWSIUS* (SALMONIFORMES: GALAXIIDAE). *N.Z. Mar. Freshwater Res.* 13(3):331-346. 1979. SFA 25(2)

[Fish Res. Div., Minist. Agric. Fish, Christchurch, New Zealand] *Neochanna burrowsius* (Phillipps) breeds in late winter and spring. Eggs are widely scattered, and adhere to leaves, stems, and suspended roots of aquatic and bankside vegetation in the sluggish or still waters of the adult habitat. Fish were successfully bred in ponds and tanks; hatching time for eggs varied greatly under different conditions of light and temperature. Fry are free swimming until they adopt the nocturnal, cryptic habits of adults when 30-50 mm long. Growth in the first year is rapid, sexual maturity being reached at 1 year old; subsequent growth is slow. Aestivation occurred successfully in shaded vegetable detritus or gravel. Holes were sometimes used, but fish did not make their own burrows for aestivation. When dissolved oxygen was low, captive fish left the water if able to do so without leaving cover.

80-001216 Gibson, R. N. and I. A. Ezzi. ASPECTS OF THE BIOLOGY OF THE SPOTTED DRAGONET *CALLIONYMUS MACULATUS* RAFINESQUE-SCHMALTZ FROM THE WEST COAST OF SCOTLAND. *J. Fish Biol.* 15(5):555-569. Nov. 1979. SFA 25(2)

[Dunstaffnage Mar. Res. Lab., Oban, Argyll, Scotland] The biology of a Scottish population of the spotted dragonet *Callionymus maculatus* was studied from Febrary 1975 to September 1976. The data were taken from monthly samples totalling over 700 fish trawled in 18-36 m on a soft mud bottom. Neither otoliths nor radial bones were found to be suitable for age determination, but evidence from other sources suggested that most growth takes place in the first two years of life and that males grow faster, but do not live as long (at least 3 years) as females (at least 5 years). Examination of the gonads showed that the spawning season probably lasts from April to September, that females mature earlier in life than males and are serial spawners. The males may reach first maturity at different ages. The sexes are markedly dimorphic. The rays of the dorsal, anal and caudal fins grow isometrically in females but growth of these organs in males is allometric after maturity has been achieved. The fish feeds predominantly on polychaetes and amphipods, although bivalve molluscs, macruran decapods and ophiuroids also occur frequently in its diet. There is some difference in the diet between length classes, smaller fish taking fewer polychaetes and more amphipods than the larger individuals. The species is finally compared with other dragonets whose biology is known.

80-001217 Goto, A.; K. Oishi and K. Takata. [BREEDING HABITS, GROWTH AND FOOD OF THE NINESPINE STICKLEBACK, *PUNGITIUS PUNGITIUS* (L.) IN AN ARTIFICIAL WATERWAY OF THE KUNEBETSU RIVER SYSTEM, HOKKAIDO.] *Bull. Fac. Fish. Hokkaido Univ.* 30(4):239-251. Nov. 1979. In Japanese with English summ. SFA 25(2)

[Lab. Embryol. Genet., Fac. Fish., Hokkaido Univ., Hakodate, Japan] The breeding habits, growth and food of the ninespine stickleback, *Pungitius pungitius* (L.), were studied in an artificial waterway of the Kunebetsu River System of Hokkaido, Japan, in order to find out the characteristics of the life history of this species. In 1978, they spawned from middle May to late June. The spawning nests were observed nearly at the root of the aquatic rooted vegetation such as *Phalaris arundinacea*, growing on the shore with moderate water current, 30 to 50 cm in depth. The fecundity of an adult female was about 40 to 80 eggs (average 57 eggs), and the egg diameter of fully riped ovarian eggs ranged from 1.3 to 1.7 mm. The deposited eggs hatched for 8 to 9 days in the water temperature of 14° to 19°. After hatching, the fry still remained in the nest for about one week, then they moved into the open water. The fry grew rapidly during the summer season. Their growth, however, became slow during the autumn and winter seasons, and seemed to almost stop until the next spring. During the spring season, the young again grew rapidly and matured. After the spawning, all seemed to die

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80-001217 CONTINUED within a month. The food of this species changed in accordance with their development. The fry in the post larval stage fed mainly on small Crustacea such as *Chylorus* and *Cyclops*. In the juvenile stage, gradual change in the food habits to feed Chironomid larvae was observed. The young fed mainly on Chironomid larvae during the autumn (September and November) and on *Asellus* during the winter (December). The next spring, their stomachs were filled with Chironomid larvae again. The adult utilized Chironomid larvae and small Crustacea as main foods. From the results stated above, it was supposed that the population of *Pungitius pungitius* in this waterway had a remarkably short life span and had the reproductive strategy that a female spawned a great number of small-sized eggs, compared with the populations in the other localities such as North America and Europe.

80-001218 Gray, R. H. and D. D. Dauble. BIOLOGY OF THE SAND ROLLER IN THE CENTRAL COLUMBIA RIVER. *Trans. Am. Fish. Soc.* 108(6):646-649. Nov. 1979. SFA 25(2)
[Freshwater Sci., Ecol. Sci. Dep., Battelle Pac. Northwest Lab., Richland, WA 99352]

80-001219 Guillory, V. LIFE HISTORY OF WARMOUTH IN LAKE CONWAY, FLORIDA. *Proc. Annu. Conf. SOutheast. Assoc. Fish Wildl. Agencies* 32:490-501. 1978[1979]. SFA 25(2)
[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle] Life history data were collected on Lake Conway warmouth (*Lepomis gulosus*) from May 1976 to August 1977. Dominant food items progressed from zooplankton to insects to crayfish with warmouth size. The sex ratio was 1.87 males to 1.00 females. Spawning was protracted, extending from April to August. Fecundity increased with length and ranged from 304 tp 8504 (mean = 1981). Condition factor increased directly with length. Length-weight regressions were computed separately for warmouth less than and greater than 100 mm. Age structure was not discernible. No warmouth fishery existed.

80-001220 Hamre, J. and T. Monstad. LODDEUNDERSØKELSER I BARENTSHAVET VINTEREN 1979. [CAPELIN INVESTIGATIONS IN THE BARENTS SEA DURING WINTER 1979.] *Fisken Havet* 1979(4):3-17. 1979. In Norwegian with English summ. SFA 25(2)
[Inst. Mar. Res., Bergen, Norway]

80-001221 Hartman, F. THREE SPINES ON A STICKLEBACK. *Nat. Hist.* 88(10):32-35. Dec. 1979. SFA 25(2)

80-001222 Healey, M. C. UTILIZATION OF THE NANAIMO RIVER ESTUARY BY JUVENILE CHINNOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*. *NOAA Fish. Bull.* 77(3):653-668. July 1979. SFA 25(2)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Chinook salmon are considered, normally, to spend from a few months to a year rearing in freshwater before migrating to sea. Although large downstream movement of fry, recently emerged from spawning gravels, has been observed in several river systems, it has been suggested that most of these migrant fry are lost to the population. This report describes the fate of downstream migrant chinook salmon fry in the Nanaimo River, British Columbia. In 1975 and 1976 most of the potential fry production from the river system was estimated to have passed by a trapping location near the river mouth. Many of these fry

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80-001222 CONTINUED were subsequently found rearing in the intertidal area at the river mouth where salinity was commonly above 20°/oo. Very few chinook salmon fry were captured at other sampling sites within a 10 km radius of the river mouth. Juvenile chinook salmon were present in the intertidal area of the estuary from March to July each year, but peak numbers occurred in April and May. Peak estuary population was estimated to be 40,000-50,000 in 1975 and 20,000-25,000 in both 1976 and 1977. While in the estuary, chinook salmon grew about 1.32 mm per day or 5.8% of their body weight per day. Individual fish probably spent an average of about 25 days rearing in the estuary and left the estuary when about 70 mm fork length. While in the estuary, juvenile chinook salmon fed on harpacticoid copepods, amphipods, insect larvae, decapod larvae, and mysids. After leaving the estuary, they fed mainly on juvenile herring. The stomach content of chinook salmon captured in the estuary averaged 5% of body weight or less, and varied seasonally and between years. It appears that in the Nanaimo and probably in other systems with well-developed estuaries, that the estuary is an important nursery for chinook salmon fry.

80-001223 Hoyt, R. D.; A. J. Waite and B. M. DiPasquale. POPULATION DYNAMICS AND CATCH SUSCEPTIBILITY OF SMALLMOUTH BUFFALO IN ROUGH RIVER RESERVOIR. *Ky. Dep. Fish. Wildl. Resour. Fish. Bull.* No. 62. vii + 67p. 1976. SFA 25(2)

[Dep. Biol., West. Ky. Univ., Bowling Green 42101] The population dynamics of the smallmouth buffalo in Rough River Reservoir (= Lake) were studied from July 1974 through June 1976. One thousand four hundred ten smallmouth buffalo were recovered from 51 collections. The population in the lake was estimated to range from 135,000 to 194,000 fish and was considered to be an underestimate. Eleven year classes were represented with the majority in two age groups. Year classes spawned in 1969-70 dominated, comprising 70% of the population. No individual less than 200 mm total length were taken. Growth in length was greatest during the first four years of life, while growth in weight was greatest in years V through XI. Growth in length and weight decreased from the first to second year of the study. Eighty-five percent of all specimens ranged from 400 to 550 mm TL. This group included fish from three through eight years of age. Fish spawned in 1965-67 showed greater first year's growth than did the remaining year classes. Condition was greatest in the smaller size individuals and progressively decreased in the larger, older individuals. Females were in slightly better condition than males. The buffalo appeared to be overcrowded and showed reduced growth from 400 mm TL and longer. Movements were greatest during March and April when fish congregated in headwater effluents to spawn. Flag nets were the most efficient type of tackle used while 3-inch mesh was the most efficient mesh size. The largest average size fish were taken in 4-inch mesh. Spawning occurred from mid-March through May. Males reached sexual maturity in the life cycle and annual reproductive condition earlier than females. Gonad development was bimodal, being closely correlated with water temperature and photoperiod. Larger, older females produced the greatest number and largest diameter mature ova. Reproductive development did not appear to be adversely affected by the population structure and density. Selective harvesting of three- to five-pound buffalo is recommended to restore a balanced age group structure and eliminate year class dominance.

80-001224 Joseph, J.; W. Klawe and P. Murphy. TUNA AND BILLFISH--FISH WITHOUT A COUNTRY. *Inter-Am. Trop. Tuna Comm., La Jolla, CA* vii + 46p. 1979. Available @ $7.95 from Inter-American Tropical Tuna Commission, P.O. Box 1529, La Jolla, CA 92093. SFA 25(2)

LIFE HISTORY-GENERAL WORKS

80-001225 Khalturin, D. K. SMOLT AGE AND THE DURATION OF THE MARINE PERIOD IN THE LIFE OF ANADROMOUS SALMONIDS (SALMONIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):871-885. 1978. SFA 25(2)
[Zool. Inst., USSR Acad. Sci., Leningrad, USSR] We know that the great variability in life history parameters of *Salmo* and *Oncorhynchus* stocks are due to many factors. Within species these may be provisionally subdivided into the following factors: 1) geographic variability - zonal-climatic differences in the ecology of the salmon stocks of one region; 2) populational variability - features of genetic differentiation of the stock and of its constituent populations. The life cycle of salmon and, in particular, smolt age, frequently turns out to be specific even in adjacent rivers in the same basin and they usually reflect differences in the temperature and feeding conditions of the waters. Nevertheless, the relationship between the time spent by the salmon before migration to the sea and the time spent in the sea is a question that is of interest in its own right.

80-001226 Lindquist, D. G. and G. T. Chandler. LIFE HISTORY ASPECTS OF THE CRESTED BLENNY, *HYPLEUROCHILUS GEMINATUS* (WOOD). *J. Elisha Mitchell Sci. Soc.* 94(2):111-112. 1978. Abstract only. SFA 25(2)

80-001227 Moreno, C. A. OBSERVATIONS ON FOOD AND REPRODUCTION IN *TREMATOMUS BERNACCHII* (PISCES: NOTOTHENIIDAE) FROM THE PALMER ARCHIPELAGO, ANTARCTICA. *Copeia* 1980(1):171-173. 1 Feb. 1980. SFA 25(2)
[Inst. Ecol. Evol., Univ. Austral Chile, Casilla 567, Valdivia, Chile]

80-001228 Ortega-Salas, A. A. SEASONAL CHANGES IN THE COMMON DAB, *LIMANDA LIMANDA* (L.) IN ISLE OF MAN WATERS. *J. Fish Biol.* 16(1):75-82. Jan. 1980. SFA 25(2)
[Cent. Ciencias del Mar Limnol., U.N.A.M. Mexico 20, D.F. Mexico] Otolith accretion was greatest in summer when opaque bands were laid down and slowest in winter when hyaline rings were formed. Food intake was minimal in winter and maximal in summer. Liver weight was high in summer and winter and low in spring after spawning. Growth in length was higher in summer than winter. Gonad weight was greatest in winter for both sexes. Spawning occurred from February to April. After spawning males recovered earlier than females and testes ripened earlier than the ovaries. From winter to summer, the sea temperature increased from 7.5-13.0°C; the day length from 7-17 h; and the salinity varied from 34.07-34.36 °/oo.

80-001229 Pasch, R. W.; P. A. Hackney and J. A. Holbrook II. ECOLOGY OF PADDLEFISH IN OLD HICKORY RESERVOIR, TENNESSEE, WITH EMPHASIS ON FIRST-YEAR LIFE HISTORY. *Trans. Am. Fish. Soc.* 109(2):157-167. Mar. 1980. SFA 25(2)
[Div. Water Resour., TVA, Norris, TN 37828]

80-001230 Patnaik, S. and S. Jena. SOME ASPECTS OF BIOLOGY OF *LATES CALCARIFER* (BLOCH) FROM CHILKA LAKE. *Indian J. Fish.* 23(1/2):65-71. 1976. SFA 25(2)
[Cent. Inland Fish. Res. Substn., Cuttack, Orissa, India] *Lates calcarifer* (Bloch) locally known as bhekti is a carnivore. While the adult fish feeds on fishes and prawns, the chief food of fry and fingerlings are copepods and mysids respectively. The general length-weight relationship followed the cube law. Maturing specimens have been observed during April-July. Ova-diameter studies revealed a single group of mature ova, indicating single spawning by each individual. The mature ovary produced on an average 0.76 million eggs per kg of fish. Bhekti is a catadromous species.

LIFE HISTORY-GENERAL WORKS

80-001231 Rivas, L. R. and D. McClellan. SUMMARY OF RESEARCH ON WESTERN NORTH ATLANTIC SHARKS CONDUCTED BY THE NATIONAL MARINE FISHERIES SERVICE, SOUTHEAST FISHERIES CENTER, MIAMI LABORATORY. *Fla. Sci.* 43(Suppl. 1):11. 1980. Abstract only. SFA 25(2)
[NMFS, 75 Virginia Beach Dr., Miami, FL 33149]

80-001232 Ryan, J. J. THE COD FAMILY AND ITS UTILIZATION. *Mar. Fish. Rev.* 41(11):25-36. Nov. 1979. SFA 25(2)
[NMFS, Emerson Ave., Gloucester, MA 01930]

80-001233 Smith-Pollard, L. PADDLEFISH. *Outdoor Okla.* 36(3):16-20. Mar. 1980. SFA 25(2)

80-001234 Tsyplakov, E. P. MIGRATIONS AND DISTRIBUTION OF THE STERLET, *ACIPENSER RUTHENUS*, IN KUYBYSHEV RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):905-912. 1978. SFA 25(2)
[Tatar Dep., State Res. Inst. Lake River Fish., Kazan, USSR] The former beds of the Volga and the Kama, and also the backwaters, are the principal habitats of the sterlet, *Acipenser ruthenus*, in Kuybyshev reservoir. The emergence of large numbers of the sterlet onto the flooded plain is to be seen only in the spring, when the sterlet consumes eggs laid by bream, roach and white bream. The sterlet typically forms dense concentrations in its winter areas. A description is given of two such areas in the Volga and the Volga-Kama arms of the reservoir. The migratory capacities of the sterlet have begun to be more clearly manifested since the formation of the reservoir; this has been a reaction of the population to the deterioration of the conditions of reproduction and it is conducive to the utilization of all the remaining spawning grounds.

80-001235 Warden, R. L., Jr. and W. A. Hubert. COMPARATIVE LIFE HISTORY FEATURES OF YOUNG-OF-YEAR SMALLMOUTH AND LARGEMOUTH BASS IN PICKWICK RESERVOIR. *J. Tenn. Acad. Sci.* 55(2):58-60. Apr. 1980. SFA 25(2)
[TVA, Muscle Shoals, AL 35660] Life history features were compared for young-of-year smallmouth and largemouth bass in Pickwick Reservoir, Alabama. Length-weight relations, condition factors, and lengths at collection were similar for both species during their first summer. Smallmouth bass from 20 to 99 mm (TL) depended heavily on Tendipedidae and Ephemeroptera for food; while largemouth bass in the same size category shifted with growth from crustaceans, to aquatic insects, to insects and fish. Both bass species were collected throughout the reservoir, and differential habitat preference were observed.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-001236 Côté, G.; P. Lamoureux; J. Boulva and G. Lacroix. SÉPARATION DES POPULATIONS DE HARENG DE L'ATLANTIQUE (*CLUPEA HARENGUS HARENGUS*) DE L'ESTUAIRE DU SAINT-LAURENT ET DE LA PÉNINSULE GASPÉSIENNE. [SEPARATION OF POPULATIONS OF ATLANTIC HERRING (*CLUPEA HARENGUS*) IN THE ST. LAWRENCE ESTUARY AND THE GASPÉ PENINSULA.] *Can. J. Fish. Aquatic Sci.* 37(1):66-71. Jan. 1980. In French with English summ. SFA 25(2)
[Minist. Pêch. Océans, C.P.-15500, Québec City, PQ G1K 7Y7, Canada]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-001237 Ager, L. M. EXPLOITATION AND MORTALITY OF LARGEMOUTH BASS IN LAKE TOBESOFKEE, GEORGIA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:429-436. 1978[1979]. SFA 25(2)

[Ga. Dep. Nat. Resour., Fort Valley 31030] Estimates of mortality and survival obtained from angler tag returns over a 10-month period following tagging were used to define the population changes that occurred in the largemouth bass (*Micropterus salmoides*) population of Lake Tobesofkee. Total mortality (A) of 30-cm and larger fish over the period was estimated at 0.911 and the exploitation rate (u) of these sizes was 0.564. The conditional rate of natural mortality was 0.602. These estimates were used to predict the relative abundance of various sizes of largemouth based on 1977 harvest and abundance data. Also the effects of various minimum length limits were predicted. Increased minimum legal size would have cut harvest to 23.7% and increased survival from 0.089 to 0.308.

80-001238 Alaska Department of Fish and Game. PRELIMINARY FORECASTS AND PROJECTIONS FOR 1980 ALASKAN SALMON FISHERIES. *Alaska Dep. Fish Game Inf. Leafl.* No. 183. i + 37p. Jan. 1980. SFA 25(2)

[Div. Commercial Fisheries, Juneau 99801] In 1979 commercial fishermen harvested 86 million salmon in Alaska, the largest catch since 1943. Statewide, the salmon harvest increased for the fifth consecutive year. A commercial harvest of 103 million salmon is projected for Alaska in 1980. The catch is not expected to be less than 60 million, nor to exceed 130 million fish. Based on projection experience since 1970, only 1 of 4 realized harvests would fall outside this range. A very large harvest of sockeye and pink salmon is anticipated in Bristol Bay, and more pink salmon are expected to return to Kodiak Island and the south side of the Alaska Peninsula. Significantly decreased salmon harvests are anticipated in Cook Inlet, Prince William Sound, and Southeastern Alaska areas.

80-001239 Barker, M. W. POPULATION AND FISHERY DYNAMICS OF RECREATIONALLY EXPLOITED MARINE BOTTOMFISH OF NORTHERN PUGET SOUND. *Ph. D. dissertation, Univ. Wash.* 143p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2497. Dec. 1979. SFA 25(2)

80-001240 Borisov, V. M. THE SELECTIVE EFFECT OF FISHING ON THE POPULATION STRUCTURE OF SPECIES WITH A LONG LIFE CYCLE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol)* 18(6):896-904. 1978. SFA 25(2)

[VNIRO, Moscow, USSR] The relative contribution made to the reproduction of a stock by spawners maturing for the first time at an age of 6, 8 and 11 years is analyzed with reference to one year-class of the Atlantic (Arctic-Norwegian) cod, *Gadus morhua morhua*. Under conditions of intensive exploitation in which total annual mortality reaches 65%, the numbers of the late-maturing subgroup are reduced to such an extent over 7 years as to make practically no contribution to reproduction (the medium-maturing subgroup is fished for 4 years before incorporation in the spawning stock, the early-maturing subgroup for 2 years). The relative contribution to reproduction of fish maturing early is, conversely, increased. Selection for early maturation is leading to a reduction in the age of the population with all the attendant adverse consequences.

80-001241 Bruger, G. E. PRELIMINARY ANALYSES OF SNOOK, *CENTROPOMUS UNDECIMALIS*, POPULATION DYNAMICS IN THE NAPLES-MARCO ISLAND REGION OF SOUTHWEST FLORIDA. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)

[Fla. Dep. Nat. Resour. Mar. Res. Lab., 100 8th Ave. S.E., St. Petersburg 33701] Snook, *Centropomus undecimalis*, have been tagged in the

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80-001241 CONTINUED Naples-Marco Island area seasonally since 1976 to assess population size, fishing and natural mortalities, movement, and growth (> 4,300 fish tagged; 14.7% average return rate). Preliminary analyses indicate that snook in this area constitute a small, heavily exploited sub-population. These fish are non-migratory (90% recaptured within 10 mi), but do make annual movements from estuarine and fresh waters to open Gulf beaches and nearshore waters during the summer spawning season.

80-001242 Hayman, R. A.; A. V. Tyler and R. L. Demory. COMPARISON OF COHORT ANALYSIS AND CATCH PER UNIT EFFORT FOR DOVER SOLE AND ENGLISH SOLE. *Trans. Am. Fish. Soc.* 109(1):35-53. Jan. 1980. SFA 25(2)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

80-001243 Helle, J. H. INFLUENCE OF MARINE ENVIRONMENT ON AGE AND SIZE AT MATURITY, GROWTH, AND ABUNDANCE OF CHUM SALMON, *ONCORHYNCHUS KETA* (WALBAUM), FROM OLSEN CREEK, PRINCE WILLIAM SOUND, ALASKA. *Ph. D. dissertation, Oreg. State Univ.* 129p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2504. Dec. 1979. SFA 25(2)

80-001244 Ita, E. O. CONTRIBUTION TO THE DYNAMICS OF MEAN-SIZE STATISTICS IN A CHANGING FISHERY: I. FAMILY CITHARINIDAE IN KAINJI LAKE, NIGERIA. *Hydrobiologia* 68(3):269-277. 16 Feb. 1980. SFA 25(2)
[Kainji Lake Res. Inst., P.M.B. 666, New Brussa, Nigeria] A model on 'The dynamics of mean-size statistics in a changing fishery' proposed by Henderson (FAO) was tested using the Kainji Lake experimental gill-net data collected between 1969 and 1977. The results revealed distinct trends in mean weight and population abundance (catch/effort) for members of the family Citharinidae. Simultaneous plots of mean weight against $\log_{10}$ of population abundance allowed the 'diagnosis' of the causes of change. Changes were attributed to the effects of fishing mortality, intensive recruitment into the fishery and change in selectivity coupled with the effect of growth. The pattern of change depicted for *Citharinus citharus* Geoffroy St. Hilaire revealed a three yearly cycle of intensive recruitment. The regression of mean weight on mean length for *C. citharus* gave a linear relationship thus facilitating the extrapolation of the mean weight values to the mean lengths of fish caught in the different meshes of gill-nets. The conversions permitted the selection of suitable mesh nets for capturing fish at appropriate levels of mean weights in order to safeguard the survival of sexually mature adults for an intensive spawning cycle.

80-001245 Kowtal, G. V. STUDIES ON THE JUVENILE FISH STOCK OF CHILKA LAKE. *Indian J. Fish.* 23(1/2):31-40. 1976. SFA 25(2)
[Cent. Inland Fish. Res. Substn., Cuttack, India]

80-001246 Krishnamoorthi, B. A NOTE ON MORTALITY RATES AND YIELD PER RECRUIT IN *NEMIPTERUS JAPONICUS* (BLOCH). *Indian J. Fish.* 23(1/2):252-256. 1976. SFA 25(2)
[Waltair Res. Cent. C.M.F.R. Inst., Waltair, Visakhapatnam 3, India] Both the yield per recruit in weight (Y_w/R) and in numbers (Y_N/R) in *Nemipterus japonicus* (Bloch) increase with increased fishing mortality i.e., with increased fishing mortality, yield increases to an asymptote. Since the rate of exploitation works to about 3% only, it seems reasonable to remark that the stocks of *N. japonicus* are very much underexploited.

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80-001247 Lehtonen, H. STOCK ASSESSMENT OF PIKE-PERCH (*STIZOSTEDION LUCIOPERCA* L.) IN THE HELSINKI SEA AREA. *Finn. Fish. Res.* 3:1-12. 1979. SFA 25(2)

[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland] Of 2,075 tagged pike-perch 361 were recaptured and reported. The most distant recovery was made 300 km from the place of release, but the fish were usually recaptured within a distance of 10 km. The pike-perch spawn in inlets and winter in deeper waters between islands and near the open sea. In the Helsinki sea area there are three separate pike-perch populations. The total annual mortality rate was estimated at 0.78 for pike-perch measuring 31 cm and more. The natural mortality rate was estimated to be 0.05-0.15. Growth takes place mainly between late July and early October. In 1970-1971 the catch per 1,000 recruits (age 3 years) was 190-260 kg and the equilibrium yield was nearly reached. Since then the fishing effort has more than doubled and the equilibrium yield may have been passed. The average density of age 3 and older pike-perch was in summer 26-42 ind./ha and the average biomass 8.4-12.6 kg/ha.

80-001248 MacCall, A. D. POPULATION ESTIMATES FOR THE WANING YEARS OF THE PACIFIC SARDINE FISHERY. *Calif. Coop. Oceanic Fish. Invest.* 20:72-82. Oct. 1979. SFA 25(2)

[Calif. Dep. Fish Game, Southwest Fish. Cent., La Jolla 92038] New sardine (*Sardinops sagax caerulea*) population estimates for the period 1945 to 1965 are calculated based on a cohort analysis of aged landings data. Three-year-old fish were incompletely recruited after 1953, requiring assumption of age 4 as age of full recruitment. The assumed natural mortality rate (M) was maintained at 0.4 for the entire time series. Landings from waters south of Punta Baja, Baja California, were excluded from the analysis. Biomass estimates are smaller than those previously given but agree well with independent indices of abundance. The new ratio of sardine spawning biomass to CalCOFI sardine larva census is double the previous value. A 95% confidence interval ranges from one quarter to quadruple the estimated biomass. The stock-recruitment relationship shows no curvature for the entire time series taken as a whole, and a purely functional description of the relationship is that mean recruitment only slightly exceeds potential replacement of spawners at all levels of abundance. Population simulations demonstrate this lack of resilience to fishing. Maximum constant fishing pressure that the population could have sustained was about 22% per year ($F = 0.25$). Maximum sustainable yield was about 250,000 tons/year, which is far below previous estimates.

80-001249 Pelzman, R. J.; S. A. Rapp and R. R. Rawstron. MORTALITY AND SURVIVAL OF TAGGED SMALLMOUTH BASS, *MICROPTERUS DOLOMIEUI* AT MERLE COLLINS RESERVOIR, CALIFORNIA. *Calif. Fish Game* 66(1):35-39. Jan. 1980. SFA 25(2)

[Calif. Dep. Fish Game, Inland Fish. Br., 1701 Nimbus Rd., Rancho Cordova 95670] A tagging study initiated in 1976 at Merle Collins Reservoir, Yuba County, provided estimated rates of exploitation (0.66), expectation of death from natural causes (0.18), and survival (0.16) for smallmouth bass, *Micropterus dolomieui*, comparable to rates recorded for largemouth bass, *M. salmoides*, at California reservoirs. A 305-mm (12.0-inch) minimum size limit on largemouth bass apparently protected smallmouth under the size limit and was probably instrumental in maintaining an attractive smallmouth bass catch despite high exploitation. Loss of shoreline habitat in the form of trees and brush has led to a decline in largemouth bass abundance and subsequent smallmouth bass dominance of bass catches at several older reservoirs.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-001250 Radovich, J. and A. D. MacCall. A MANAGEMENT MODEL FOR THE CENTRAL STOCK OF THE NORTHERN ANCHOVY, *ENGRAULIS MORDAX*. *Calif. Coop. Oceanic Fish. Invest.* 20:83-88. Oct. 1979. SFA 25(2)

[Calif. Dep. Fish Game, Sacramento 95814] The average growth of the northern anchovy central subpopulation between the years 1951 and 1975, as measured by CalCOFI egg and larva surveys, can be empirically described by a logistic growth curve. The asymptotic maximum population size, or spawning biomass, is 4 million short tons, and the intrinsic rate of increase is 0.36. A maximum average growth rate of 360,000 short tons/year occurs at a spawning biomass of 2 million tons. If the population were maintained at 2 million tons by harvesting surplus production, an estimated 450,000 short tons/year could be harvested. The difference between yield and population growth rate is due to the competing risk of death between fishing mortality and natural mortality. This estimate of potential productivity is smaller than previous estimates, but is better founded.

80-001251 Selifonov, M. M. THE OCEAN CATCH OF SEXUALLY IMMATURE SOCKEYE SALMON, *ONCORHYNCHUS NERKA*, OF THE OZERNAYA RIVER POPULATION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):839-843. 1978. SFA 25(2)

[KOTINRO, Petropavlovsk-Kamchatskiy, USSR] Data on catches of immature sockeye salmon, *Oncorhynchus nerka*, from Ozernaya River population in the period 1962-1972 was analyzed. The catch was determined by an analysis of biomass dynamics. The increase in biomass (growth) exceeds the loss from natural mortality in the sea. Poor catches are increasing as the exploitation rates of sexually mature fish increases. The catch of immature fish causes a reduction in the abundance of the population. It is concluded that fishing for immature Ozernaya River sockeye in the sea is irrational.

80-001252 Simonova, N. A. POPULATION DYNAMICS OF KAMCHATKA RIVER SOCKEYE SALMON, *ONCORHYNCHUS NERKA*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):722-733. 1978. SFA 25(2)

[KOTINRO, Petropavlovsk-Kamchatskiy, USSR] The abundance of year-classes and the biological indicators of Kamchatka River sockeye salmon depends not only on the abundance of the spawning population and conditions of reproduction and foraging in fresh water, but also on conditions in the sea: on the number of smolts and the abundance of simultaneously foraging sockeye populations from other waters.

80-001253 Sjöblom, V. and R. Parmanne. ABUNDANCE OF BALTIC HERRING OFF THE COAST OF FINLAND IN 1956-78 ACCORDING TO EXPLORATORY FISHING WITH A PELAGIC TRAWL. *Int. Counc. Explor. Sea.* C.M. 1979/J:21. 10p. 1979. In Finnish with English summ. SFA 25(2)

[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland] The density of the Baltic herring stock is almost the same in all the sea areas around Finland. In the Gulf of Finland the density in the 1970's has been only half of that in the 1960's. Judged by the abundance of juvenile herring, propagation in the northern part of the Bothnian Sea and in the Bothnian Bay is lower than off the southern Finnish coast. There have been no changes in the level of propagation during the observation period.

80-001254 Sjöblom, V. and R. Parmanne. ABUNDANCE OF SPRAT EGGS AND LARVAE IN THE NORTHERN BALTIC IN 1978. *Int. Counc. Explor. Sea.* C.M. 1979/J:20. 5p. 1979. In Finnish with English summ. SFA 25(2)

[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-001255 Sjöblom, V. and R. Parmanne. THE YEAR CLASS STRENGTH OF SPRING SPAWNING BALTIC HERRING ESTIMATED FROM ABUNDANCE OF LARVAE IN THE SEAS AROUND FINLAND IN 1974-79. *Int. Counc. Explor. Sea.* C.M. 1979/J:19. 9p. 1979. SFA 25(2)
[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland]

80-001256 Sjöblom, V. and R. Parmanne. ABUNDANCE OF SPRAT OFF THE COAST OF FINLAND IN 1956-68 AND 1975-78 ACCORDING TO EXPLORATORY FISHING WITH A PELAGIC TRAWL. *Int. Counc. Explor. Sea.* C.M. 1979/J:18. 9p. 1979. In Finnish with English summ. SFA 25(2)
[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland]

80-001257 Wagner, D. S.; J. B. Averill and M. C. Miller. VARIATION IN LARVAL DENSITIES IN THE OHIO RIVER, MELDAHL POOL. *Ohio J. Sci.* 80:94. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Cincinnati, Cincinnati, OH 45421] The larval fish population in the Ohio River was sampled weekly at six sites, April to August, 1976 to 1978, near Maysville, Kentucky. Data on the pattern and length of appearance of fish species coincides with the known life histories of these species. Total larval fish densities in 1976 were greater than in 1978 and 1977 respectively. In 1976, the highest mean density was 1382 larvae/100 m^3 on June 11; 196/100 m^3 on June 27, 1978; and 121/100 m^3 on June 17, 1977. These highest density dates coincide with the first sample date where water temperature reached 25C or greater. The taxonomic composition of samples differed between 1976 and 1977. In 1976, the earliest collections were predominantly suckers (Catastomidae), comprising 76.7% of identifiable larvae from a total abundance of 15.4 larvae/100 m^3. On all succeeding dates, over 80% of identifiable larvae were clupeids and/or minnows. Suckers were more predominant in 1977. In contrast, clupeid densities dropped a thousandful from 1976 to 1977. A model for estimating the total larval fish population in the area will be discussed.

80-001258 Wiley, R. W. and D. J. Dufek. STANDING CROP OF TROUT IN THE FONTENELLE TAILWATER OF THE GREEN RIVER. *Trans. Am. Fish. Soc.* 109(2):168-175. Mar. 1980. SFA 25(2)
[Rt. 2, Box 25, Laramie, WY 82070]

80-001259 Woodrum, J. E. COMPARISON OF ROTENONE AND ELECTROFISHING POPULATION ESTIMATES TO LAKE DRAINING. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:634-638. 1978[1979]. SFA 25(2)
[W.Va. Dep. Nat. Resour., P.O. Box 67, Elkins 26241] The results from cove rotenone sampling and electrofishing population estimates for largemouth bass (*Micropterus salmoides*) were compared with the total largemouth bass populations obtained through draining of Sherwood Lake, a 67 ha impoundment in southeastern West Virginia. Rotenone samples over-estimated all size groups of largemouth bass (fingerling, intermediate and harvestable) both in number and weight. Electrofishing (Schnabel population estimates) more closely represented the numbers and weight of largemouth bass recovered at the lake draining. Schnabel estimates were 10,096 (7,870-14,079) while total draining produced 9,224 bass. Electrofishing standing crop was estimated at 151 fish/ha and 8.3 kg/ha while draining totals were 138 fish/ha and 9.9 kg/ha.

80-001260 Yeager, D. M. and H. J. Van Den Avyle. RATES OF ANGLER EXPLOITATION OF LARGEMOUTH, SMALLMOUTH, AND SPOTTED BASS IN CENTER HILL RESERVOIR, TENNESSEE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl.*

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80-001260 CONTINUED *Agencies* 32:449-458. 1978[1979]. SFA 25(2)
[Tenn. Coop. Fish. Res. Unit, Tenn. Tech. Univ., Cookeville 38501] A tag-and-reward procedure was used to estimate exploitation rates of black bass (*Micropterus* sp.) during 1975 and 1976 in Center Hill Reservoir, Tennessee. Returns of reward tags by anglers indicated annual exploitation rates of 13.3 (22.2%) for largemouth (*M. salmoides*), 12.9 (15.6%) for smallmouth (*M. dolomieui*) and 14.8 (18.5%) for spotted bass (*M. punctulatus*). Within each year, exploitation rates were not significantly different between species or size groups. Rates were lower in 1976 than in 1975 for all species, but the difference was significant only for largemouth bass. In 1975, when tag reward values were publicly announced, most data suggested that tags with no reward value were returned at rates lower than those observed for reward tags. In 1976, when a random-reward procedure was used, differential rates of return were not detected. Monthly graphs of recaptures (R) expressed as a percentage of the total catch (C) from creel survey data indicated that tag loss and (or) differential mortality caused exploitation estimates based on 12 months of returns to be too low. If R/C ratios had remained at levels similar to those observed during the first 2 or 3 months following tagging, rates of about 30% would have been observed for all species in both years. Comparisons of observed and adjusted exploitation rates with estimated rates of natural mortality indicated that overharvest of black bass is probably not occurring in Center Hill Reservoir.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

80-001261 Alldridge, N. A. and Andrew M. White. SPAWNING SITE PREFERENCES FOR NORTHERN PIKE (*ESOX LUCIUS*) IN A NEW YORK MARSH WITH WIDELY FLUCTUATING WATER LEVELS. *Ohio J. Sci.* 80:13. 1980. Abstract only. SFA 25(2)
[Case-Western Reserve Univ., Cleveland, OH] Numerous literature accounts of the spawning of Northern Pike indicate that the species spawns over substrates of flooded terrestrial grasses, early in spring. In the spring of 1979 we studied an area in Conesus Lake, New York in which water levels of the marsh fluctuated widely during the spawning season. Available substrates for spawning included flooded areas of Canary Grass, Rice Cut Grass, Cattail, leaf litter, pondweeds, Polygonums, Buttonbush, old field forbs, sawdust and brushpiles and bulrushes. More than 140 observations of spawning indicated that preferences were correlated with depth, not vegetation type and that as depths changed in the marsh, substrates utilized shifted accordingly. Further, heavy or thick types of vegetation (Cattail, Buttonbush, brush) were consistantly avoided. These results indicate that the spawning of the Northern Pike occurs in open water areas, over any available vegetation so long as depths were within the range of approximately 6 to 24 inches, (12.06 ± 3.01 inches) and Cattail, brush or bushes were absent. Spawning occurred consistantly at temperatures above 5.5 C and on days when the area was iced spawning was delayed until late afternoon.

80-001262 Artyukhin, Ye. N.; A. D. Sukhoparova and L. G. Fimukhina. THE GONADS OF THE STURGEON, *ACIPENSER GULDENSTADTI*, IN THE ZONE BELOW THE DAM OF THE VOLGOGRAD WATER ENGINEERING SYSTEM. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):912-923. 1978. SFA 25(2)
[Cent. Lab. Reprod. Fish Stocks, Glavrybvod, Nizhnevolzhrybvod, USSR] The results of observations on the state of the gonads of the mature sturgeon, *Acipenser guldenstadti*, from the area below the dam of the Volgograd hydraulic engineering system in different seasons are presented. The dynamics of changes in the state of the gonads is discussed in relation to the nature

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80-001262 CONTINUED of the migration and the time of spawning. Descriptions are given of impaired gametogenesis in some of the fish both below the dam and in the reservoir, to which the fish are transferred by a fish lift.

80-001263 Colman, J. A. SPAWNING OF THE SPRAT, *SPRATTUS ANTIPODUM* (HECTOR), ROUND THE SOUTH ISLAND OF NEW ZEALAND. *N.Z. J. Mar. Freshwater Res.* 13(20):263-272. 1979. SFA 25(2)
[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19-062, Wellington, New Zealand] The distribution of eggs of the sprat, *Sprattus antipodum* (Hector), in the plankton of coastal waters round the South Island of New Zealand during winter and spring of 1973, 1974, and 1975 is described from the results of plankton surveys with a high-speed sampler. The principal spawning grounds were in the Canterbury Bight, with other spawning areas off the Otago coast and the West Coast. The stock of sprats in the Canterbury Bight was estimated to be at least 60,000 t.

80-001264 Fischer, E. A. MATING SYSTEM AND SIMULTANEOUS HERMAPHRODITISM IN THE CORAL REEF FISH, *HYPOPLECTRUS NIGRICANS* (SERRANIDAE), WITH A DISCUSSION OF THE SYSTEMATIC STATUS OF THE SPECIES IN THE GENUS *HYPOPLECTRUS*. *Ph.D. dissertation, Univ. Calif. (Berkeley)* 161p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(7):3037. Jan. 1980. SFA 25(2)

80-001265 Glebe, B. D.; T. D. Appy and R. L. Saunders. VARIATION IN ATLANTIC SALMON (*SALMO SALAR*) REPRODUCTIVE TRAITS AND THEIR IMPLICATIONS IN BREEDING PROGRAMS. *N. Am. Salmon Res. Cent. Rep.* No. 4. 11p. 1979. SFA 25(2)
[Huntsman Mar. Lab., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Analysis of variance of inter and intra-strain crosses of Atlantic salmon from four New Brunswick rivers indicated a strong maternal influence on progeny size. The reproductive traits, egg size and energy content and fecundity, were investigated as possible causes of this effect. The lack of a significant difference ($p>.75$) in energy content of unit weights of ova from each stock suggested similar proximate compositions. However, significant differences in egg diameter ($p<.01$) existed as did a significant correlation ($p<.01$) between egg size and progeny mean length. No correlation between egg size and juvenile survival was detected. The calculated energy content per ovum ranged from 1066 J (SD=215) for the Magaguadavic stock to 1576 J (SD=140) for salmon of Rocky Brook origin. Increased egg size may have contributed to a significant depression in fecundity of Rocky Brook females. The importance of understanding the relative influence of maternal effects associated with reproductive traits in salmon breeding studies is discussed.

80-001266 Goldberg, S. R. SEASONAL SPAWNING CYCLES OF TWO MARINE COTTID FISHES, *CHITONOTUS PUGETENSIS* AND *ICELINUS QUADRICERIATUS* FROM SOUTHERN CALIFORNIA. *Bull. Mar. Sci.* 30(1):131-135. Jan. 1980. SFA 25(2)
[Dep. Biol., Whittier Coll., Whittier, CA 90608] Spawning cycles are described for two marine cottids from southern California. Histological analyses of seasonal collections indicated both species had prolonged spawning periods with maximum spawning activity from late winter to early spring. Spawning declined in summer, however, small numbers of females in spawning condition were collected in fall and early winter indicating the

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80-001266 CONTINUED likelihood of some year-round spawning. It is postulated that both species produce at least three egg clutches per year. The winter peak spawning activity began earlier in 1978 than it did in 1977.

80-001267 Gubanov, Ye. P. THE REPRODUCTION OF SOME SPECIES OF PELAGIC SHARKS FROM THE EQUATORIAL ZONE OF THE INDIAN OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):781-792. 1978. SFA 25(2)
[AzCherNIRO, Kerch, USSR]

80-001268 Hancock, R. S. THE ANNUAL CYCLE OF INTRAOVARIAN EGG SIZE AND FECUNDITY OF THE BARBEL *BARBUS BARBUS* IN THE RIVER SEVERN. *Freshwater Biol.* 9(6):535-542. Dec. 1979. SFA 25(2)
[Dep. Fish., Univ. Technol., P.O. Box 793, Lae, Papua New Guinea] The annual cycle of intraovarian egg size in 124 mature barbel caught during a 3-year period was investigated. Storage methods, subsampling and measuring procedures were assessed and found to be reliable. Estimates of fecundity were made on thirty-two barbel containing developing ripening eggs. A new egg separation and counting technique was used modified from the volumetric ratio method described by Bagenal & Braum. Fecundity estimates were found to be accurate by comparison with manual counts. Barbel ovaries contained two egg groups throughout the year. A third large, ripening egg group developed prior to spawning. The diameter of the ripening eggs, measured in arbitrary optical units, was significantly correlated with fork length. Large fish spawned bigger eggs than small fish. Fecundity was logarithmically related to fork length and ovary weight and linearly related to somatic weight. The mean diameter of the ripening intraovarian egg group was also logarithmically related to ovary weight. Heavier ovaries contained proportionally fewer, but larger, ripening eggs than small ovaries.

80-001269 Hayashi, Y. [STUDIES ON THE MATURITY AND THE SPAWNING OF THE RED TILEFISH IN THE EAST CHINA SEA--II. SPAWNING PATTERN ESTIMATED FROM THE MONTHLY CHANGES OF OVARIAN EGG DIAMETERS.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1475-1479. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Yamaguchi Pref. Gachai Fish. Exp. Stn., Senzaki, Nagato 759-41, Japan] The present paper aimed to make clear the spawning pattern of the red tilefish, *Brachiostegus japonicus japonicus*, by investigating the diameter distribution curves of their ovarian eggs. Samples of 273 ovaries were collected from the fish landed by bottom long-liners in the East China Sea during the period from April 1974 to March 1976. The results obtained were summarized as follows; 1) The ovaries were classified into eight types of maturation stage by analyzing the pattern of distribution curves of ovarian egg diameters. 2) Judging from the frequency distribution for each type in every month, it was concluded that the spawning of larger females (BL≥240 mm) last for five months from June to October. But spawning in September was not so active. 3) In the case of smaller females (BL<240 mm), it was estimated that most of them spawned in June, July and October, a few of them in only October and the remainder in June and July.

80-001270 Honda, H. FEMALE SEX PHEROMONE OF THE AYU, *PLECOGLOSSUS ALTIVELIS*, INVOLVED IN COURTSHIP BEHAVIOUR. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1375-1380. Nov. 1979. SFA 25(2)
[Cent. Res. Inst. Elec. Power Industry, Abiko, Chiba 270-11, Japan] This report deals with the courtship behaviour and the presence of a female sex pheromone of the Ayu, *Plecoglossus altivelis*. Increased ventilatory frequencies and fin display reactions in the male Ayu were elicited by the water sample inclusive of post-ovulatory females. It was noticed that the males were able to discriminate post-ovulatory females from pre-ovulatory

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80-001270 CONTINUED females without actually sighting the female. Some highlighted aspects derived from these experiments are listed as follows: 1. Post-ovulatory females released a female sex pheromone, which males detect by olfaction. 2. The female sex pheromone, produced in the ovaries of post-ovulatory females, is secreted through the urogenital papilla. 3. The female sex pheromone was found to be a water-ether soluble basic substance, having an Rf value of 0.43 on the thin layer chromatogram (silica gel) with a chyclohexane-ethyl alcohol (4:1) solvent. 4. The female sex pheromone from post-ovulatory females played the role of first trigger, inducing a series of courtship behaviour of the Ayu.

80-001271 Hopkins, C. L. REPRODUCTION IN *GALAXIAS FASCIATUS* GRAY (SALMONIFORMES: GALAXIIDAE). *N.Z. J. Mar. Freshwater Res.* 13(2):225-230. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] A study of the reproductive cycle was made on *Galaxias fasciatus* Gray from streams on Banks Peninsula, South Island, New Zealand. There was no spawning migration; adults remained in the usual adult habitat to breed. The course of gonad maturation showed that spawning occurred in the autumn, from end of April to mid-June. Most males matured at 2 years of age and most females at 4 years old. Egg numbers in the females varied from 3,800 to 23,600. Males were predominant in age groups 1-4, females in the older age groups. Amongst fish of potential breeding age there was an excess of males. Circumstantial evidence suggested that eggs were laid among piles of water-logged debris lodged in pools and backwaters. The larvae, which are briefly described, probably hatch during floods to be swept quickly downstream to the sea.

80-001272 Hunter, J. R. and S. R. Goldberg. SPAWNING INCIDENCE AND BATCH FECUNDITY IN NORTHERN ANCHOVY, *ENGRAULIS MORDAX*. *NOAA Fish. Bull.* 77(3):641-652. July 1979. SFA 25(2)

[NMFS, P.O. Box 271, La Jolla, CA 92038] Histological criteria were developed to age postovulatory follicles from examination of laboratory-spawned northern anchovy and used to estimate the frequency of spawning of natural populations. One-day-old, postovulatory follicles were the preferred estimator of spawning frequency; 48 hours after spawning postovulatory follicles could not be consistently identified because of their rapid degeneration; and the occurrence of postovulatory follicles less than 24 hours old was affected by hour of sampling and sexual composition of the school. The nightly spawning incidence was estimated to be 16±4% of the northern anchovy population in February and 12% in March. Thus, females spawned about every 6-8 days during the peak of the breeding season. The rate of oocyte development corresponded with this reproductive rate, indicating that a new mode of yoked oocytes matured about once a week. Nearly all eggs in the most advanced mode in the ovary were spawned in one night and the number of eggs spawned was estimated to be 389±59 eggs/g of female (ovary-free wet weight). The high spawning frequency and the prolonged breeding season of the northern anchovy indicate that total fecundity may be limited by food availability and energy reserves.

80-001273 Lazurus, S. ON THE OCCURRENCE OF OILSARDINE IN THE SPAWNING STAGE OFF VIZHINJAM. *Indian J. Fish.* 23(1/2):249-252. 1976. SFA 25(2)

[Vizhinjam Res. Cent. C.M.F.R. Inst., Vizhinjam, India] The occurrence of ripe and spawning oilsardine, *Sardinella longiceps* Val. off Vizhinjam is reported for the first time. Ova-diameter studies reveal a bimodal distribution of ova and fecunity estimates of the primary and secondary modes were about 46,000 and 88,000 ova respectively.

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80-001274 Malmqvist, B. THE SPAWNING MIGRATION OF THE BROOK LAMPREY, *LAMPETRA PLANERI* BLOCH, IN A SOUTH SWEDISH STREAM. *J. Fish Biol.* 16(1):105-114. Jan. 1980. SFA 25(2)

[Dep. Anim. Ecol., Ecol. Bldg., S-223 62 Lund, Sweden] The spawning migration of brook lampreys (*Lampetra planeri*, Bloch) was investigated in a South Swedish lake and stream system for two consecutive years. The nightly variations were analysed by a multiple regression technique. In one of the seasons, characterized by frequent rain storms, water level was the most important factor explaining 60% of the observed variation in migration. In the following year, when the migration period was unusually dry, temperature and on-shore winds at the mouth of the stream were the most influential environmental variables explaining 50% of the observed changes in behaviour. When data were combined for the two years only temperature showed a significant influence. The critical temperature for the onset of migration was estimated to be 7.5°C. Size distributions and sex ratios of the migrating lampreys, which are semelparous, indicated that the age distribution was complex and that females were older than males. Migration was essentially nocturnal, but late in the season day migration was also observed. A marking experiment resulted in few recaptures probably because of high predation and/or orientation difficulties.

80-001275 Marliave, J. B. SPAWNING AND YOLK-SAC LARVAE OF THE AGONID FISH SPECIES, *AGONOMALUS MOZINOI* WILIMOVSKY AND WILSON. *Syesis* 11:285-286. 1978. SFA 25(2)

[Vancouver Publ. Aquarium, P.O. Box 3232, Vancouver, BC V6B 3X8, Canada]

80-001276 Mathur, D.; P. L. McCreight and G. A. Nardacci. VARIATIONS IN FECUNDITY OF WHITE CRAPPIE IN CONOWINGO POND, PENNSYLVANIA. *Trans. Am. Fish. Soc.* 108(6):548-554. Nov. 1979. SFA 25(2)

[Radiation Manage. Corp., Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518]

80-001277 McCarley, H. and L. G. Hill. REPRODUCTION OF *LEPISOSTEUS SPATULA* (LEPISOSTEIDAE) IN LAKE TEXOMA. *Southwest. Nat.* 24(4):694-695. 10 Dec. 1979. SFA 25(2)

[Dep. Biol., Austin Coll., Sherman, TX 75090]

80-001278 Misitano, D. A. A RECORD OF INTERNAL FERTILIZATION IN THE ROUGHBACK SCULPIN *CHITINOTUS PUGETENSIS* WITH DESCRIPTIVE NOTES OF THEIR EARLY LARVAE. *Copeia* 1980(1):162-165. 1 Feb. 1980. SFA 25(2)

[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001279 Mueller, G. EFFECTS OF RECREATIONAL RIVER TRAFFIC ON NEST DEFENSE BY LONGEAR SUNFISH. *Trans. Am. Fish. Soc.* 109(2):248-251. Mar. 1980. SFA 25(2)

[Water Power Serv., Div. Plan., Box 427, Boulder City, NV 89005]

80-001280 Olsen, E. K. DISTRIBUTION OF PELAGIC YELLOW PERCH AND WALLEYE FRY IN TWO NORTHERN WISCONSIN LAKES. *Ph.D. dissertation, Univ. Wis.* 100p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2563. Dec. 1979. SFA 25(2)

Yellow perch and walleye fry migrated upward in Escanaba Lake soon after light intensities began to increase before dawn. From late May through early July they were more abundant at 1 m when light intensities (at 1 m) were between .1 and .05 lux (~0500 CST). As light intensity continued to increase, the fry again moved deeper and when light intensities were between

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80-001280 CONTINUED $10^{3.5}$ and 10^{4} lux, they were more abundant at 3 m, where they generally remained until evening. Fry tended to be deeper on afternoons when surface waters were more turbulent. In early evening (~1800 CST) when light intensity was ~10^{4} lux, both species were more abundant at 3 m, but migrated upward at dusk to become more abundant at 1 m when light intensities were between 10^{2} and 1 lux (2000-2100 CST). At night, downward movement usually occurred when light intensity was lowest (< .15 lux). Once, under a full moon, yellow perch and walleye concentrated at 1 m. The morning and evening upward movement of fry may have lengthened the period when yellow perch and walleye were able to perceive prey. The morning descent placed fry in midwater where zooplankton was at maximum abundance. Temperature gradients were usually slight in both lakes and a thermal strategy of vertical migration is unlikely. In the laboratory, walleye (~12 mm in length) and yellow perch (~10 mm in length) fry were positively phototactic at .0001 lux and .001 lux, respectively, and the walleye were negatively phototactic at 10^{5} lux. Walleye fry ~32 mm in length were negatively phototactic at 3 lux. Perch fry were never significantly photonegative, even at intensities > 10^{5} lux. Walleye fry in Little John Lake, attracted to the light of a gas lantern at night, were most abundant over the deeper parts of the lake and absent in water Φ2 m deep. Yellow perch fry in Escanaba Lake were also abundant over deep water, but were not uncommon in more inshore regions.--From abstr.

80-001281 Pavlov, D. A. THE DEVELOPMENT OF THE ANADROMOUS KAMCHATKA TROUT, *SALMO MYKISS*, AND ITS POSITION IN THE CLASSIFICATION OF *SALMO*. *J. Ichthyol.* (*Engl. Transl. Vopr. Ikhtiol.*) 18(6):923-936. 1978. SFA 25(2)
[Dep. Ichthyol., Moscow Univ., USSR]

80-001282 Rinne, J. N. SPAWNING HABITAT AND BEHAVIOR OF GILA TROUT, A RARE SALMONID OF THE SOUTHWESTERN UNITED STATES. *Trans. Am. Fish. Soc.* 109(1):83-91. Jan. 1980. SFA 25(2)
[Rocky Mountain For. Range Exp. Stn., Ariz. State Univ., Tempe]

80-001283 Scott, A. P.; M. Htun-Han; V. J. Bye; J. R. C. Springate and S. M. Baynes. EFFECT OF PHOTOPERIOD ON GONADAL MATURATION OF FEMALE DAB (*LIMANDA LIMANDA* L.). *Gen. Comp. Endocrinol.* 40(3):336. Mar. 1980. Abstract only. SFA 25(2)
[Fish. Lab., Lowestoft, NR33 0HT, England] Several experiments have been carried out to assess the effect of photoperiod manipulation on the development of the ovaries in dab (*Limanda limanda* L.). An early observation by Htun-Han (unpublished results) was that dabs subjected to a 4L:8D:4L:8D photoperiod from July reached full maturity in October, 6 months ahead of the normal spawning season. We attempted to repeat this observation (with two groups of eight female dabs), but started the experimental photoperiod in March. Other groups of fish were exposed to a normal photoperiod, an accelerated "6-month cycle," and 16L:8D (thought to be inhibitory). All fish were bled monthly, and plasmas assayed for oestradiol, testosterone, and cortisol. Gonadal maturation did not appear to be influenced by the experimental photoperiods. Levels of oestradiol and testosterone started to rise in all fish in October/September and peaked in January/February. By March, all surviving fish had ovulated. Further experiments are planned to test whether the time of year at which dabs are subjected to experimental photoperiods is an important factor in inducing early maturation.

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80-001284 Smith, D. G. EARLY LARVAE OF THE TARPON, *MEGALOPS ATLANTICA* VALENCIENNES (PISCES: ELOPIDAE), WITH NOTES ON SPAWNING IN THE GULF OF MEXICO AND THE YUCATAN CHANNEL. *Bull. Mar. Sci.* 30(1):136-141. Jan. 1980. SFA 25(2)

[Mar. Biomed. Inst., Univ. Tex. Med. Br., Galveston 77550] A description is given of the early larval stages of the tarpon, emphasizing the pre-flexion and flexion stages, up to about 12 mm standard length. A 5.7 mm specimen retained part of the yold sac and is the smallest tarpon larva known. At a length of about 10-11 mm flexion of the notochord occurs and dorsal and anal pterygiophores appear. Hypurals and caudal-fin rays develop at flexion; dorsal- and anal-fin rays appear somewhat later, at about 16 mm. Pelvic fins appear at about 21 mm. Maximum size before metamorphosis is about 28 mm SL. Spawning occurs in the spring and summer in the Yucatan Channel and the Gulf of Mexico. Spawning areas are located off Cozumel, off the west coast of Florida, and in the southwestern Gulf of Mexico. The duration of larval life is about 3 months.

80-001285 Sumpter, J. P. and J. M. Dodd. THE ANNUAL REPRODUCTIVE CYCLE OF THE FEMALE LESSER SPOTTED DOGFISH, *SCYLIORHINUS CANICULA* L., AND ITS ENDOCRINE CONTROL. *J. Fish Biol.* 687-695. Dec. 1979. SFA 25(2)

[Dep. Appl. Biol., Sch. Biol. Sci., Brunel Univ., Uxbridge, Middlesex UB8 3PH, England] Various aspects of the reproductive physiology of the female lesser spotted dogfish, *Scyliorhinus canicula* L., demonstrate marked annual cycles. Pituitary ventral lobe gonadotrophin content and plasma oestradiol and testosterone levels rise through the autumn as the ovary recrudesces and the percentage of fish bearing eggs in the oviducts increases. The pituitary gonadotrophin and plasma sex steroid levels remain elevated throughouth the winter but decrease during the spring, two months prior to a fall in both the gonadosomatic index (GSI) and the percentage of fish with eggs in their oviducts. The lowest gonadotrophin and sex steroid levels are found in early summer, again preceding the minimum GSI and rate of egg-laying by two or three months. Some of these cycles are pronounced, the pituitary gonadotrophin levels varying by more than 100-fold, and the oestradiol levels by more than 10-fold, throughout the year. It is concluded that the female dogfish has a very extended breeding season, though the peak frequency of egg-laying occurs in the winter and spring.

80-001286 Taubert, B. D. REPRODUCTION OF SHORTNOSE STURGEON (*ACIPENSER BREVIROSTRUM*) IN HOLYOKE POOL, CONNECTICUT RIVER, MASSACHUSETTS. *Copeia* 1980(1):114-117. 1 Feb. 1980. SFA 25(2)

[Ill. Nat. Hist. Surv., Aquatic Biol. Sect., Nat. Resour. Bldg., Urbana 61801] Shortnose sturgeon (*Acipenser brevirostrum*) spawned in the Holyoke Pool of the Connecticut River, Massachusetts, between 3 and 9 May 1977 and 10 and 12 May 1978. For 1977, water temperatures were 12-15 C, flows 304-481 m^3/s and velocities 37-56 cm/s, whereas those in 1978 were 10-12 C, 962-1,155m^3/s and 104 to 125 cm/s. Reproductively mature shortnose sturgeon and their larvae were only found in the upper, riverine end of Holyoke Pool where the substrate was mostly rubble. Shortnose sturgeon spawned first at 10 years and next at 17.9, and averaged 8.1 years between spawnings. Average weight and length at 10 years were 1,522 g and 579 mm FL and at 18 years, 3,166 and 747.

80-001287 Taylor, M. H. and L. DiMichele. OVARIAN CHANGES DURING THE LUNAR SPAWNING CYCLE OF *FUNDULUS HETEROCLITUS*. *Copeia* 1980(1):118-125. 1 Feb. 1980. SFA 25(2)

[Sch. Life Health Sci., Univ. Del., Newark 19711] The lunar spawning cycle of *Fundulus heterclitus* is accompanied by cyclic changes in ovarian hydration, egg size and follicular development. Maxima in these parameters

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80-001287 CONTINUED occur in synchrony with the spring tide spawning peak. The pattern of ovarian maturation in this lunar or semilunar cycle is similar to that seen in the annual reproductive cycle of this species.

80-001288 Walsh, J. J.; T. E. Whitledge; W. E. Esaias; R. L. Smith; S. A. Huntsman; H. Santander and B. R. De Mendiola. THE SPAWNING HABITAT OF THE PERUVIAN ACHOVY, *ENGRAULIS RINGENS*. *Deep-Sea Res. A Oceanogr. Res. Pap.* 27(1):1-27. Jan. 1980. SFA 25(2)

[Oceanogr. Sci. Div., Brookhaven Natl. Lab., Upton, NY 11973] Individual larvae of the anchovy *Engraulis ringens* appear to survive better off the northern coast of Peru during the austral winter season when a motil algal food supply is available. Concentrations of the dinoflagellate food of the first feeding anchovy larvae may be reduced less often by wind events in the north than in the south. Under El Niño conditions, more of the adult anchovy are found south within a less favorable spawning habitat, in terms of dilution and food quality, where there is evidently less larval survival and subsequent recruitment to adult stocks. Increased mortality of the larvae during 1965, 1972, and 1976 El Niños and of the adults during the 20-year fishery has reduced the present stock to less than 20% of its biomass in times of peak yield. Such a change in food chain dynamics is reflected in transients of oxygen demand at the decadal scale of variability. Associated with an increase in zooplankton biomass and a decline of the anchovy fishery, the sardine species of the clupeid pair off Peru may also be increasing in number, implying that natural oscillations of clupeoids may be accelerated by overfishing.

80-001289 West, J. L. INTRAGRAVEL CHARACTERISTICS IN SOME WESTERN NORTH CAROLINA TROUT STREAMS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:625-633. 1978[1979]. SFA 25(2)

[Dep. Biol., West. Carolina Univ., Cullowhee, NC 28723] Characteristics of the intragravel environment of Southern Appalachian trout streams have not been studied. It was the purpose of this study to measure intragravel permeability, apparent velocity, temperature, dissolved oxygen, and bottom composition in areas that visually appeared suitable for trout spawning in 8 relatively undisturbed streams in the Pisgah National Forest of western North Carolina. Comparisons were made between these measurements and the development requirements of salmonid embryos. Two types of standpipes were used, the Mark VI groundwater standpipe and polyvinyl chloride (PVC) standpipes. The lowest mean intragravel dissolved oxygen was 3.2 mg/l. Dissolved oxygen measured by the Mark VI was consistently higher than when measured by the PVC standpipes which indicates that the Mark VI gives a better measure of the true intragravel dissolved oxygen than does the PVC standpipes. Between 1 November and 30 April, the period when trout embryos are in the gravel, none of the intragravel dissolved oxygen measurements taken with the Mark VI were below 6 mg/l. The data indicate that during the development period the dissolved oxygen was adequate for normal embryo survival. Between 1 November and 30 April the intragravel temperature varied from 0.5 to 11 C, temperatures considered to be adequate for trout spawning and embryo development. On a given sampling day the temperature varied no more than 0.5 C from one site to another and the mean intragravel temperature was about the same as the mean surface temperature. This indicates that most of the intragravel water is from surface origin rather than from ground sources. Mean apparent velocity varied from 3.5 to 42.7 cm/hour and mean permeability from 838 to 1,967 cm/hour. The mean percentage of the bottom sample between 0.84 and 3.36 mm varied from 8.8 to 28.2%. When the measurements are compared with requirements of salmonid embryos and alevins, the areas sampled are adequate for embryo survival. There is a possibility that the embryos are smaller than if intragravel dissolved oxygen and apparent velocity were higher. With the exception of 1 creek, it is probable that the amount of sand does not affect fry emergence.

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80-001290 Sjöblom, V. and R. Parmanne. THE VERTICAL DISTRIBUTION OF BALTIC HERRING LARVAE (*CLUPEA HARENGUS* L.) IN THE GULF OF FINLAND. *Finn. Fish. Res.* 2:5-18. 1978. SFA 25(2)

[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland] The vertical distribution was investigated to determine the right sampling technique for assessing the abundance of larvae. Larvae were caught at all the sampling depths. In the early summer they were most abundant at 16 m. In the middle and end of the summer most larvae were found between depths of 0.2 and 2 m. The greatest catch of Baltic herring larvae was made in May in the evening at 16 m, 3.7 larvae/m^3. In the early summer the larvae were found in deep water by day and closer to the surface at night. Later in the summer the larvae were close to the surface by day and deeper at night. This difference was not explained by either the light or the size of the larvae. Vertical migration was, however, greater in the big than in the small larvae. In the middle of the summer the speed of the upward movement in the morning could be 0.4 cm/sec. Vertical distribution did not depend on the temperature of the water, and movement was not prevented by a temperature gradient of 4°C. Nor did vertical distribution appear to be affected by wind velocity. The occurrence of the Baltic herring larvae did not parallel the vertical distribution of zooplankton.--From abstr.

80-001291 Guillory, V. UTILIZATION OF AN INUNDATED FLOODPLAIN BY MISSISSIPPI RIVER FISHES. *Fla. Sci.* 42(4):222-228. 1979. SFA 25(2)

[Fla. Game Fresh Water Fish Comm., P.O. Box 1903, Eustis] The movement of main channel Mississippi River species on an adjoining floodplain was associated with flooding. Of 62 species collected, 24 were characteristic of the main channel and 15 occurred equally in both floodplain or main channel habitats. The presence of juveniles and/or spawning adults indicate that backwaters serve as important nursery areas for riverine fishes.

80-001292 Kelley, D. BASS POPULATIONS AND MOVEMENTS ON THE WEST COAST OF THE U.K. *J. Mar. Biol. Assoc. U.K.* 59(4):889-936. Nov. 1979. SFA 25(2)

[Old Farm, Trebetherick, Wadebridge, Cornwall, England]

80-001293 Kriete, W. H., Jr.; J. V. Merriner and H. M. Austin. MOVEMENT OF 1970 YEARCLASS STRIPED BASS BETWEEN VIRGINIA, NEW YORK, AND NEW ENGLAND. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:692-696. 1978[1979]. SFA 25(2)

[Va. Inst. Mar. Sci., Gloucester Point 23062] Striped bass (*Morone saxatilis*) were tagged in Virginia beginning in 1968. The 1970 yearclass of striped bass was tagged both in Virginia and New York in 1972. Fish tagged in Virginia were returned from New York to Maine while fish tagged in New York were returned from the Maryland portion of the Chesapeake Bay and the Potomac River. These data indicated that fish migrate from rivers in which they were spawned at different ages and that fish that migrate as 2 year olds remain together as a group until they are 3+ years. Therefore, within the Chesapeake Bay area there are distinct river populations at least until these populations are 3+ years old.

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80-001294 Maeda, T.; T. Takahashi and M. Ueno. [ECOLOGICAL STUDIES ON THE ALASKA POLLACK IN THE ADJACENT WATERS OF THE FUNKA BAY, HOKKAIDO--III. SEASONAL VARIATIONS OF HYDROGRAPHIC CONDITIONS]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1137-1142. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-001295 Sjöblom, V. and R. Parmanne. THE VERTICAL DISTRIBUTION OF BALTIC HERRING LARVAE (*CLUPEA HARENGUS* L.) IN THE GULF OF FINLAND. *Finn. Fish. Res.* 2:5-18. 1978. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O.B. 193, SF-00131, Helsinki 13, Finland] The vertical distribution was investigated to determine the right sampling technique for assessing the abundance of larvae. Sampling was done in May-August 1974 at Sipoonselkä in the Gulf of Finland, using the modified Gulf V sampler equipped with an auxiliary net for parallel zooplankton samples. At six times during the day and night, the sampler was towed at a speed of 4 knots for 20 minutes at depths of 0.2, 1, 2, 4, 8 and 16 m. In all 4699 Baltic herring larvae were caught. Larvae were caught at all the sampling depths. In the early summer they were most abundant at 16 m. In the middle and end of the summer most larvae were found between depths of 0.2 and 2 m. The greatest catch of Baltic herring larvae was made in May in the evening at 16 m, 3.7 larvae/m^3. In the early summer the larvae were found in deep water by day and closer to the surface at night. Later in the summer the larvae were close to the surface by day and deeper at night. This difference was not explained by either the light or the size of the larvae. Vertical migration was, however, greater in the big than in the small larvae. In the middle of the summer the speed of the upward movement in the morning could be 0.4 cm/sec. Vertical distribution did not depend on the temperature of the water, and movement was not prevented by a temperature gradient of 4°C. Nor did vertical distribution appear to be affected by wind velocity. The occurrence of the Baltic herring larvae did not parallel the vertical distribution of zooplankton.

80-001296 Tsukamoto, K.; S. Masuda; Y. Mori; and T. Kajihara. [DISPERSION OF AYU JUVENILES IN THE TSUBUSA RIVER--III. COMPARISON BETWEEN HATCHERY-REARED AYU AND WILD AYU.] *Bull. Jpn. Soc. Sci. Fish.* 45(11):1365-1370. In Japanese with English summ. SFA 25(2)
[Ocean Res. Inst., Univ. Tokyo, Nakano, Tokyo, Japan]

80-001297 Vigg, S. SEASONAL BENTHIC DISTRIBUTION OF ADULT FISH IN PYRAMID LAKE, NEVADA. *Calif. Fish Game* 66(1):49-58. Jan. 1980. SFA 25(2)
[Bioresources Center, Desert Research Inst., Reno, NV 89506] Relative densities of five fish species were determined at successive depth intervals during September, December, March, and June 1976-1977. For the total study period, an inverse relationship existed between depth and fish density for all species. Sacramento perch, *Archoplites interruptus*, were taken exclusively inshore. Inshore sampling stations accounted for 97% of the mean cui-ui, *Chasmistes cujus*, catch, and 73% of the Tahoe suckers, *Catostomus tahoensis*. Lahontan cutthroat trout, *Salmo clarki henshawi*, and tui chub, *Gila bicolor*, exhibited more complex distribution patterns, which varied on a temporal basis in relation to temperature and dissolved oxygen regimes. Tui chubs composed about 98% of the total catch at depths greater than 61 m. Trout production in this profundal zone was assumed to be negligible since the numbers present were low and the temperature was less than 7°C during all seasons.

80-001298 Williams, R. O. and R. G. Taylor. THE EFFECT OF WATER TEMPERATURE AND WINTER AIR TEMPERATURE ON THE SPRINGTIME MIGRATIONS OF KING MACKEREL IN THE VICINITY OF TAMPA BAY, FLORIDA. *Fla. Sci.*

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

80-001298 CONTINUED 43(Suppl. 1):26. 1980. Abstract only. SFA 25(2)
[Fla. Dep. Nat. Resour. Mar. Res. Lab., 100 8th Ave. S.E., St. Petersburg 33701] This paper reviews the springtime migrations of the king mackerel, *Scomberomorus cavalla*, in the vicinity of Tampa Bay, Florida during each of the past twenty years and demonstrates that their date of first appearance is directly dependent on offshore water temperature (Min. 20°C) and indirectly on prevailing air temperatures during the previous winter. The springtime arrival date of king mackerel to the Tampa Bay area was established by reviewing daily newspaper recreational fishing columns. Offshore water temperatures were compiled from various sources and are available for twelve of the past twenty years. Air temperatures for Tampa, Florida were available from annual summaries of the U.S. National Weather Service.

FOODS/FEEDING

80-001299 Axell, M-B. FEEDING OF COD IN THE ÅLAND SEA AND ITS INFLUENCE ON THE STOCKS OF HERRING AND SPRAT. *Int. Counc. Explor. Sea.* C.M. 1979/J:22. 8p. 1979. In Finnish with English summ. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland] Altogether 460 cod, sampled in different seasons, were examined by the points method. The ratio of fish to invertebrates in their stomachs was 2:1. Sprat received higher points than herring (30.5% vs. 23.6%), although herring predominated in the stomachs of the larger cod. The food consumed by the stock of cod in the whole Baltic Sea was estimated on the basis of the data from the Åland Sea. The annual predation on the stock of herring was calculated as 35% and that on sprat as 58%. The food intake is given according to length groups to permit direct calculation of the annual consumption by a certain stock.

80-001300 Barwick, D. H. FOOD OF LARVAL BLACK CRAPPIES IN RELATION TO ELECTRICAL POWER GENERATION, KEOWEE RESERVOIR, SOUTH CAROLINA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:485-489. 1978[1979]. SFA 25(2)
[U.S. FWS, Southeast Reservoir Invest., Clemson, SC 29631] Food of larval (5.0-10.9 mm, TL) black crappies (*Pomoxis nigromaculatus*) from Keowee Reservoir, SC, was determined in 1973, before commercial power generation began from a 2,580-MW nuclear power plant, and in 1976 after 3 years of commercial power generation. Although water temperatures were higher in 1976 than in 1973, food of the larvae appeared to be unchanged by operation of the plant. The principal organisms eaten were *Diaphanosoma* sp. and copepod nauplii.

80-001301 Brock, R. E. THE EFFECTS OF GRAZING BY PARROTFISHES (FAMILY SCARIDAE) ON SELECTED SHALLOW HAWAIIAN MARINE COMMUNITIES. *Ph. D. dissertation, Univ. Wash.* 186p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2502. Dec. 1979. SFA 25(2)

80-001302 Cannamela, D. A.; J. D. Brader and D. W. Johnson. FEEDING HABITS OF CATFISHES IN BARKLEY AND KENTUCKY LAKES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:686-691. 1978[1979]. SFA 25(2)
[Hancock Biol. Stn., Murray State Univ., Murray, KY 42071] Indices of relative importance and forage ratios are presented for food items of channel (*Ictalurus punctatus*) and blue catfishes (*I. furcatus*) collected from

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FOODS/FEEDING

80-001302 CONTINUED two large impoundments in western Kentucky. Data reported include samples collected from September 1977 to April 1978. Young of the year catfishes from both lakes relied heavily on zooplankton and aquatic insects. Other food items which were seasonally important included debris, trichopterans, bryozoans, and fish. Teleosts were the most important food items of intermediate sized (150-300 mm TL) catfishes in both lakes. Hexageniid mayflies were important to Kentucky Lake catfishes, but not to Barkley Lake catfishes; the converse was true of bryozoans. Omnivorous feeding habits characterized large harvestable (>300 mm TL) catfishes. Food items of harvestable catfishes included fish, insect larvae, debris, and one deermouse (*Peromyscus* sp.); pelecypods occurred consistently in the diet of Barkley Lake catfishes. Diversity of food items in catfish diets may be affected by the relative abundance of the 2 species in each lake. It is postulated that interactions between catfishes could alter availability and/or selection of food items.

80-001303 Clark, A. L. and W. D. Pearson. EARLY PISCIVORY IN POSTLARVAE OF THE WHITE BASS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:409-414. 1978[1979]. SFA 25(2)

[Woodward-Clyde Consultants, 3489 Kurtz St., San Diego, CA 92110] Gut content analysis of postlarval white bass (*Morone chrysops*) collected from the Ohio River near Louisville, Kentucky, revealed that prolarval carp (*Cyprinus carpio*) were the major food item for postlarvae of 7-12 mm standard length (SL), although no larval fish were found in the stomachs of postlarvae 12-13 mm SL. The frequency of occurrence of zooplankton (primarily copepods and cladocerans) in the diet increased steadily from 20 to 100% as the postlarvae grew from 6.5 to 13.0 mm SL. The ecological implications of such early piscivory are discussed.

80-001304 Combs, D. L. FOOD HABITS OF ADULT STRIPED BASS FROM KEYSTONE RESERVOIR AND ITS TAILWATERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:571-575. 1978[1979]. SFA 25(2)

[Okla. Dep. Wildl. Conserv., Muskogee 74401] During 1974, 1975 and 1976, stomachs of 467 adult striped bass (*Morone saxatilis*) from Keystone Reservoir and its tailwaters were collected and examined for content. Gizzard shad (*Dorosoma cepedianum*) was the most abundant food item found in striped bass stomachs. The relationships between the length of striped bass and the length of gizzard shad consumed was not significant (.05%). Seasonal and habitat variations in the diet were not significant (.05%).

80-001305 Demski, L. S. A "HYPOTHALAMIC FEEDING AREA" IN THE BRAINS OF SHARKS AND TELEOSTS. *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)

[Sch. Biol. Sci., Univ. Ky., Lexington 40506] Recent findings in teleosts indicate that an area of the hypothalamus (dorsal or subglomerular part of the inferior lobe) is involved in the regulation of feeding. The results are based on experiments utilizing brain stimulation, lesion and recording techniques. At least in goldfish, neurons in this area are preferentially activated by olfactory and gustatory input. Comparative anatomical studies suggest that a similar and probably homologous area is present in the shark hypothalamus and feeding activity has been elicited by electrical stimulation of this area in free-swimming nurse sharks. Thus, although the direct evidence in elasmobranchs is still meager, it seems likely that the shark inferior lobe is also involved in the control of feeding. The indication from studies in teleosts that this region is sensitive to olfactory stimuli is consistent with frequent observations that many sharks and teleosts can be strongly aroused to feed in response to certain chemical stimuli.

FOODS/FEEDING

80-001306 Diana, J. S. THE FEEDING PATTERN AND DAILY RATION OF A TOP CARNIVORE, THE NORTHERN PIKE (*ESOX LUCIUS*). *Can. J. Zool.* 57(11):2121-2127. Nov. 1979. In English with French summ. SFA 25(2)

[Ecol. Fish. Wildl. Prog., Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Food habits, digestive rates, and daily ration were determined for 1290 northern pike (*Esox lucius*) collected from Lac Ste. Anne, Alberta. The data were used to develop a model for quantifying the daily ration of a top carnivore; the basic feature was that feeding time was short relative to time between meals. Pike diet included mainly perch (*Perca flavescens*), spottail shiners (*Notropis hudsonius*), burbot (*Lota lota*), and white suckers (*Catostomus commersoni*), in order by numerical importance. Caloric intake by pike depended mainly on perch, suckers, and burbot, in that order; the difference between the two rankings was due to differences in the size of individuals eaten. Gastric evacuation rate (determined by controlled experiment) was 48 h in summer and 12 days in winter. Daily ration was high from May to August (peaking in June) and very low in winter. Both sexes of pike exhibited a spawning fast in late April. Female rations were 1.5 to 2.3 times the male values in summer and winter. The rare inclusion of large prey items, such as suckers and burbot, had a very significant effect on the total caloric intake of pike.

80-001307 Domermuth, R. B. and R. J. Reed. FOOD OF JUVENILE AMERICAN SHAD, *ALOSA SAPIDISSINA*, JUVENILE BLUEBACK HERRING, *ALOSA AESTIVALIS*, AND PUMPKINSEED, *LEPONIS GIBBOSUS*, IN THE CONNECTICUT RIVER BELOW HOLYOKE DAM, MASSACHUSETTS. *Estuaries* 3(1):65-68. Mar. 1980. SFA 25(2)

[Radiation Manage. Corp., Box 286, R.D. 1, Middletown, DE 19709] Despite a paucity of avilable prey, little feeding competition occurred between juvenile American shad, *Alosa sapidissima*, juvenile blueback herring, *Alosa aetivalis*, and pumpkinseed, *Lepomis gibbosus*, in the Connecticut River below Holyoke Dam. Pumpkinseed differed from clupeids in pronounced selection for chironomid larvae, and bottom feeding. Feeding conflicts between the two *Alosa* species were reduced by: 1) more opportunistic feeding by shad: 2) differential selection for cladoceran prey; 3) higher utilization of copepods by herring.

80-001308 Eldon, G. A. FOOD OF THE CANTERBURY MUDFISH, *NEOCHANNA BURROWSIUS* (SALMONIFORMES: GALAXIIDAE). *N.Z. J. Mar. Freshwater Res.* 13(2):255-261. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] Food found in the stomachs of 367 *Neochanna burrowsius* (Phillips) ranging in length from 6 to 167 mm was examined. Fish were collected from nine habitats, mainly in South Canterbury. Small monthly samples (mean of n + 13) of adult fish were collected for 9 months from one site, and 3 samples of fry came from the same place. Samples of juveniles were collected monthly for 7 months from a second site, and miscellaneous samples of adults or juveniles were collected from 7 other places. The stomachs of two samples of aestivating fish were also examined. Observations on feeding in an artificial pond showed that fish were attracted by live food but were incapable of catching swift prey. Food was predominantly insect larvae and Crustacea, chiefly chironomids and ostracods. Seventy-five per cent of aestivating fish were found to have food residues in their stomachs.

80-001309 Fahy, E. PREY SELECTION BY YOUNG TROUT FRY (*SALMO TRUTTA*). *J. Zool. (Lond.)* 190(1):27-37. Jan. 1980. SFA 25(2)

[Fish. Res. Cent., Dep. Fish. For., Abbotstown, Castlenock, Co. Dublin, Ireland] Factors influencing the choice of invertebrate food by early feeding trout are sought, special attention being given to the dimensions of the prey. The stomach contents of fish of similar age feeding on lake plankton

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80-001309 CONTINUED and drifting stream fauna are compared. Little consistent preference was displayed for the smaller planktonic organisms but prey size was of importance in the distribution of stream benthos among predators of different lengths. The width of the prey was of greater significance to selection than the mean volume or the area of the largest surface of the food items. When the fish were in obvious competition for food the correlation between predator length and all prey dimensions improved.

80-001310 Fiscus, C. H. INTERACTIONS OF MARINE MAMMALS AND PACIFIC HAKE. *Mar. Fish. Rev.* 41(10):1-9. Oct. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] The biology, feeding habits, seasonal distribution, and range of the Pacific hake, *Merluccius productus*, are briefly described. The commercial hake fishery is also discussed. Marine mammals inhabiting the range of the Pacific hake are listed and population estimates are given when known. The known or suspected marine mammal predators on hake are described in detail. The range and seasonal distribution of each species is given and principal prey species (including hake) are discussed. A partial listing of fish which prey on hake is given.

80-001311 Fitzmaurice, P. SELECTIVE PREDATION ON CLADOCERA BY BROWN TROUT *SALMO TRUTTA* L. *J. Fish Biol.* 15(5):521-525. Nov. 1979. SFA 25(2)
[Inland Fish. Trust, Inc., Glasnevin, Dublin 9, Ireland] The size and species composition of zooplankton ingested by brown trout in Lough Sheelin was studied. Zooplankton and fish samples were taken simultaneously. The zooplankton samples consisted of *Daphnia hyalina* var. *galeata*, Copepoda and *Bythotrephes longimanus* in the proportion of 246:10:1. The entire stomach contents of the fish were examined with particular attention paid to the zooplankton component. The results indicated a high degree of selection for *B. longimanus*.

80-001312 Foltz, J. W. and S. H. Bowen. CHROMIC OXIDE IN FOOD ASSIMILATION STUDIES. *Trans. Am. Fish. Soc.* 108(6):650-652. Nov. 1979. SFA 25(2)
[Dep. Entomol. Econ. Zool., Clemson Univ., Clemson, SC 29631]

80-001313 Geistdoerfer, P. RECHERCHES SUR L'ALIMENTATION DE *MACROURUS BERGLAX* LACÉPÈDE 1801 (MACROURIDAE, GADIFORMES). [STUDIES ON THE FOOD OF *MACROURUS BERGLAX* LACÉPÈDE, 1801 (MACROURIDAE, GADIFORMES).] *Ann. Inst. Oceanogr.* 55(2):135-144. 1979. In French with English summ. SFA 25(2)
[Lab. Ichtyol. Gen. Appl., Mus. Natl. Hist. Nat., 43 rue Cuvier F 75231 Paris, France] The food habits of *Macrourus berglax* were studied at various seasons in the North Atlantic. The 584 *M. berglax* specimens (2078 preys) came from 88 trawl catches made by *Thalassa* and *Cryos*, research vessels of the Institut scientifique et technique des Pêches maritimes: in the Barents Sea, in summer 1974; on the Iceland-Faeroë Ridge, in spring 1975; in the Labrador Sea, in summer 1975 and winter 1976; in the Baffin Sea, in autumn 1977. *M. berglax* feeds essentially on benthic groups, especially two major categores: 1) Amphipods Cammarids (24.1 % of prey), Ophiuroids (20.1 %) and Polychaetes (15.5 %): 2) Fishes (8.9 %) and Shrimps (8.6 %). The amount of these two categores ingested varies in relation to the size of *M. berglax*: as the fish grow the intake of the first category decreases sharply.

80-001314 Gillen, A. L. and T. Hart. FEEDING INTERRELATIONSHIPS BETWEEN THE SAND SHINER AND THE STRIPED SHINER. *Ohio J. Sci.* 80(2):71-76. Mar. 1980. SFA 25(2)

FOODS/FEEDING

80-001314 CONTINUED
[Dep. Zool., Ohio State Univ., 1735 Neil Ave., Columbus, 43210] Feeding habits of *Notropis stramineus* and *N. chrysocephalus* were investigated in Buffalo Creek, Washington County, PA during September through December, 1977. As an opportunistic feeder, *N. stramineus* consumed large quantities of terrestrial (appx. 40%) and aquatic (appx. 50%) insects during September and October, but shifted almost entirely to insects in the benthic environment (ppx. 90%), such as mayfly numphs (*Caenis* and *Stenonema*) and stonefly nymphs (*Alloperla* and *Isoperla*), in November and December. *N. stramineus* utilized a wide range of prey with the bulk of aquatic prey (9-12 mm) including crayfish (*Orconectes*), large mayfly nymphs (*Stenonema*), and damselfly naiads (*Argia*) from September through November; however, in December its diet shifted to *Cladophora* and aquatic Chironomidae larvae. Although diet overlap was nearly complete initially (September and October), it diminished as the season progressed. Food habits were unique to each species late in the year, suggesting that as food resources decline the food habits of these two species appear to diverge, minimizing interspecific competition.

80-001315 Gruber, S. H. ROLE OF THE LEMON SHARK *NEGAPRION BREVIROSTRIS* AS A PREDATOR IN THE TROPICAL MARINE ENVIRONMENT: A PROGRESS REPORT. *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)
[RSMAS, Univ. Miami, Miami, FL 33149]

80-001316 Heller, R. and M. Milinski. OPTIMAL FORAGING OF STICKLEBACKS ON SWARMING PREY. *Anim. Behav. (Baillière Tindall, London)* 27(4):1127-1141. Nov. 1979. SFA 25(2)
[Abt. Biol., Ruhr-Univ. Bochum, Postfach 102148, 4630 Bochum 1, West Germany] Hungry sticklebacks, *Gasterosteus aculeatus*, preferentially attacked the densest region of a swarm of water fleas, but with decreasing attack readiness they increasingly preferred less dense regions. Such a hunger dependent change in feeding preference has not yet been dealt with by optimal foraging theory. A model, which assumes that high swarm densities provide high feeding rates (because of small inter-prey distances) but also high costs of confusion, predicts that a predator should always choose the lowest prey density in which it can achieve a feeding rate sufficient to satisfy its hunger. Some predictions of the model were experimentally verified. Hungry fish have a higher feeding rate in a high prey density than in a low density and less hungry fish have a higher rate in a low density than in a high density.

80-001317 Hoover, J. J. FEEDING ECOLOGY OF TWO SYMPATRIC SPECIES OF *NOTROPIS* (PISCES: CYPRINIDAE) FROM THE HILLSBOROUGH RIVER. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. South Fla., Tampa 33620] Collections of *N. petersoni* and *N. hypselopterus* from the Hillsborough River were made during the periods August 1973-May 1974 and April 1978-June 1979, in order to ascertain the feedig habits of the two species. Both fish fed on aufwuchs, with the dominant food items represented by diatoms, *Closterium*, rotifers, pelecypods, crustaceans, and aquatic insects. The consumption of adult chironomids indicated that *N. hypselopterus*, and to a lesser extent, the smaller stages of *N. petersoni*, had greater accessibility to these insects than did the larger individuals of *N. petersoni* occurring deeper in the water column. Horn's Coefficient of Dietary Overlap was calculated between the two species and was often in excess of .60, but during both sampling periods exhibited autumn and early winter depressions when overlap was comparatively low (.01-.31).

FOODS/FEEDING

80-001318 Ishiwata, N. [ECOLOGICAL STUDIES ON THE FEEDING OF FISHES--XI. EXTERNAL FACTORS AFFECTING SATIATION AMOUNT]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1275-1276. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Tokyo Univ. Fish., Minato-ku, Tokyo 108, Japan] The satiation amount is standardized by the method described in the previous reports and the influence of the size of school on the satiation amount is examined. The results obtained are summarized as follows: The satiation amount of a school of fish declines when its number falls below a certain number, thus exhibiting group effect. This is an example of a psychological factor influencing food consumption.

80-001319 Kokova, V. Ye. THE FEEDING OF LARVAE OF THE WHITEFISH, *COREGONUS LAVARETUS LUDOGA*, THE BAIKAL OMUL, *COREGONUS AUTUMNALIS MIGRATORIUS*, AND THE "PELED", *COREGONUS PELED*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):953-960. 1978. SFA 25(2)
[Inst. Phys., Siberian Dep., USSR Acad. Sci., Krasnoyarsk, USSR]

80-001320 Lane, E. D.; M. C. S. Kingsley and D. E. Thornton. DAILY FEEDING AND FOOD CONVERSION EFFICIENCY OF THE DIAMOND TURBOT: AN ANALYSIS BASED ON FIELD DATA. *Trans. Am. Fish. Soc.* 108(6):530-535. Nov. 1979. SFA 25(2)
[Biol. Dep., Malaspina Coll., 900 5th St., Nanaimo, BC V9R 5S5, Canada]

80-001321 Langton, R. W. and R. E. Bowman. FOOD OF FIFTEEN NORTHWEST ATLANTIC GADIFORM FISHES. *NOAA Tech. Rep. NMFS SSRF* 740. iv + 23p. Feb. 1980. SFA 25(2)
[NMFS, Woods Hole, MA 02543] The food of 15 species of gadiform fishes occurring in the northwest Atlantic, from Cape Hatteras, N.C., to Nova Scotia have been investigated for the years 1969-72. The populations of Atlantic cod, *Gadus morhua*; pollock, *Pollachius virens*; silver hake, *Merluccius bilinearis*; white hake, *Urophycis tenuis*; offshore hake, *Merluccius albidus*; and cusk, *Brosme brosme*; have reasonably similar diets, being primarily piscivorous. The red hake, *Urophycis chuss*, and spotted hake, *Urophycis regius*, also have similar diets and are mixed feeders, preying on both fish and invertebrates. The final seven species, haddock, *Melanogrammus aeglefinus*; longfin hake, *Phycis chesteri*; fourbeard rockling, *Enchelyopus cimbrius*; marlin-spike, *Nezumia bairdi*; longnose grenadier, *Coelorhynchus carminatus*; fawn cusk-eel, *Lepophidium cervinum*; and ocean pout, *Macrozoarces americanus*; prey almost exclusively on invertebrates.

80-001322 Liem, K. F. ADAPTIVE SIGNIFICANCE OF INTRA- AND INTERSPECIFIC DIFFERENCES IN THE FEEDING REPERTOIRES OF CICHLID FISHES. *Am. Zool.* 20(1):295-314. 1980. SFA 25(2)
[Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138]

80-001323 Linfield, R. S. J. ECOLOGICAL CHANGES IN A LAKE FISHERY AND THEIR EFFECTS ON A STUNTED ROACH *RUTILUS RUTILUS* POPULATION. *J. Fish Biol.* 16(2):123-144. Feb. 1980. SFA 25(2)
[Anglian Water Auth., Diploma House, Grammar School Walk, Huntingdon, Cambs. PE18 6NZ, England] Data for two sampling years (1969/70 and 1970/71) is presented to illustrate the changing composition, density and biomass of the macroinvertebrate fauna in a South Lancashire lake. Six faunal groupings are recognised for a non-parametric analysis of the data and significance levels are given for the between-station and between-year differences recorded. The mean density of macroinvertebrates (1-2 mm mesh sieve) estimated for the lake as a whole increased by 28.5% in the second year (2519/m^2-3237/m^2) whereas the estimated mean biomass in g/m^2

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80-001323 CONTINUED increased by 86% wet weight (8.61-16.01) and 196% dry weight (1.74-5.15). Molluscs contributed substantially to the increased standing crop which was accompanied by increased development of macrophytes. A comparative study of the diets of roach in two size groups in winter and summer is described. The variety of food items consumed was found to be greater than in a preliminary study in May 1969 and, for the roach sampled, the average quantity of food consumed per fish increased after the 1969/70 winter. The possible relationships between invertebrate standing crop, roach diet and previously reported changes in the growth of the roach are discussed and an explanation is offered concerning the sequence of biological changes observed in the lake.

80-001324 Longval, M. and R. Warner. FOOD INTAKE OF THE LEMON SHARK *NEGAPRION BREVIROSTRIS* UNDER CONTROLLED CONDITIONS. *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)

[RSMAS, Univ. Miami, Miami, FL 33149] Food intake of the lemon shark was investigated to determine whether apparent hunger and satiation plays a role in their behavior. Lemon sharks (two males and two females) were placed under constant conditions and given 45-minute feeding trials per day for 100 days. During a trial the sharks were offered pre-weighed, 10 gram pieces of catfish filet and their *ad libitum* rate of feeding individually monitored. The average shark consumed 50.7 g per day (5065 g in 95 days) and gained 867.2 g. It thus converted 17.1% of its ration into growth and storage. The remaining 82.9% was metabolized or excreted. An 8% increase in total length was also recorded. A time-series analysis of the intake data revealed peaks at 4 and 7 days. We suggest that the 4-day peak reflects an internally-mediated periodic variable. The 7-day peak is probably an experimental artifact. This differs from an earlier study which claimed 15-day periods of food intake.

80-001325 MacCrimmon, H. R. and T. K. Twongo. ONTOGENY OF FEEDING BEHAVIOUR IN HATCHERY-REARED RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *Can. J. Zool.* 58(1):20-26. Jan. 1980. In English with French summ. SFA 25(2)

[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Development of feeding behaviour in young rainbow trout, *Salmo gairdneri*, from "swim-up" to day 57 after hatch at 8.5°C is described relative to food type (live *Artemia salina* or dry trout ration) and water flow (current or no current). Earliest signs of feeding behaviour appear during the process of swim-up at days 27 to 29, with the movement of the eyes to fixate particles and the beginning of a snap response which intensifies within 2 days. Initially the alevins are nonselective between food and inert targets, but by about day 25 at the test temperature they have become able to discriminate food from nonfood items, and show a marked increase in exogenous feeding activity. The timing, which will differ at different rearing temperatures, coincides approximately with final absorption of the visible yolk sac and follows disappearance of the oesophageal plug by about 10 days. This would seem to be the best time to initiate artificial feeding of hatchery-reared alevins, with the fish showing a preference for ingestion of live food (shrimp nauplii) over dry rations. Despite evident behavioural differences in current and no-current conditions this factor had little effect on timing or ultimate success of first feeding. Failure of some alevins to begin feeding, or feed adequately for survival, is associated with the agonistic behaviour of more aggressive siblings.

80-001326 Markovtsev, V. G. FOOD CHAINS AND FISH PRODUCTION IN LAKE KHANKA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1017-1021. 1978. SFA 25(2)

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80-001326 CONTINUED
[TINRO, Vladivostok, USSR] The food supply of the lake is represented mainly by organisms from four trophic levels. It is possible to assume approximately that around 10% of the final fish production is formed from organisms of the first trophic level, 33% from organisms of the second trophic level, 47% from organisms of the third trophic level and 10% from organisms of the fourth trophic level. Such a distribution of the final fish production by trophic levels is one of the reasons for the existing low fish productivity of the lake. Starting from an analysis of the trophic links of the most abundant commercial species of the lake it is possible to recommend intensive hatchery propagation of the carp, silver carp, grass carp and also non-migratory predators, mainly the skygazer.--Concl.

80-001327 Mikhman, A. S. and M. I. Bryazgunova. THE FEEDING OF *SCOPHTHALMUS MAEOTICUS MAEOTICUS* AND *PLATICHTHYS FLESUS LUSCUS* LARVAE IN TAGANROG GULF. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):857-858. 1978. SFA 25(2)
[AzNIIRKh, Rostov on Don, USSR]

80-001328 Milinski, M. AN EVOLUTIONARILY STABLE FEEDING STRATEGY IN STICKLEBACKS. *J. Comp. Ethol.* 51(1):36-40. Sept. 1979. In English with German summ. SFA 25(2)
[Abt. Biol., Ruhr-Univ. Bochum, West Germany] When offered a choice between two simulated drift food patches 6 three-spined sticklebacks (*Gasterosteus aculeatus* L.) distributed themselves between the two patches in the ratio of patch profitabilities. This is an example of an "ideal free distribution" which could be achieved either if all fishes used the same pure strategy of feeding where reward rate is assessed to be highest, or if they adopted a mixture of that strategy and of random choice. Conditions for either possibility to be evolutionarily stable are discussed.

80-001329 Milinski, M. CAN AN EXPERIENCED PREDATOR OVERCOME THE CONFUSION OF SWARMING PREY MORE EASILY? *Anim. Behav. (Baillière Tindall, London)* 27(4):1122-1126. Nov. 1979. SFA 25(2)
[Abt. Biol., Ruhr-Univ. Bochum, Postfach 102148, 4630 Bochum 1, West Germany] Three-spined sticklebacks (*Gasterosteus aculeatus* L.) which had previously fed on *Daphnia* in a high density swarm subsequently attacked a prey swarm (which had all known characteristics enhancing confusion) differently from fish fed equal numbers of *Daphnia* from a lower density swarm. Predators which had previously encountered low density prey hesitated longer before the first attack, attacked less and at a lower rate, and ceased hunting earlier than those fish that had previously prefed upon the high density *Daphnia*. Possible causes of the difference in attack behaviour are discussed.

80-001330 Morris, D. J. and B. J. Follis. EFFECTS OF STRIPED BASS PREDATION UPON SHAD IN LAKE E. V. SPENCE, TEXAS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:697-702. 1978[1979]. SFA 25(2)
[Tex. Parks Wildl. Dep., Ingram 78025] Striped bass (*Morone saxatilis*) introduced into Lake E. V. Spence, a west Texas reservoir, showed reduced growth rates as shad (*Dorosoma* sp.) declined. To study the relationship between these phenomena, scales and stomach samples were collected from striped bass caught in gill nets, and the standing crop of shad was estimated from rotenone samples in August, 1972-1978. Declines in both striped bass

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80-001330 CONTINUED growth and occurrence of food items in their stomachs coincided with the depletion of 76 and 178 mm shad after 1972. Surviving gizzard shad (*D. cepedianum*) grew rapidly, but threadfin shad (*D. petenense*) virtually disappeared as brood fish were decimated. Reducing the annual stocking rate rate from 24.7 to 12.4 striped bass fingerlings/ha in 1976 may have allowed gizzard shad to establish sufficient reproductive capacity to provide adequate forage.

80-001331 Nielsen, L. A. EFFECT OF WALLEYE (*STIZOSTEDION VITREUM VITREUM*) PREDATION ON JUVENILE MORTALITY AND RECRUITMENT OF YELLOW PERCH (*PERCA FLAVESCENS*) IN ONEIDA LAKE, NEW YORK. *Can. J. Fish. Aquatic Sci.* 37(1):11-19. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061]

80-001332 Pearcy, W. G.; C. C. E. Hopkins; S. Grønvik and R. A. Evans. FEEDING HABITS OF COD, CAPELIN, AND HERRING IN BALSFJORDEN, NORTHERN NORWAY, JULY-AUGUST 1978: THE IMPORTANCE OF EUPHAUSIIDS. *Sarsia* 64(4):269-277. 1979. SFA 25(2)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331] Midwater and bottom trawls were used at two stations (120 and 180 m depth) in Balsfjorden during the summer of 1978 to study the feeding of fishes on euphausiids, one of the major causes of 120 kHz sound scattering. The principal food of cod consisted of capelin (*Mallotus villosus*), euphausiids (*Thysanoessa rachii, T. inermis*, and *Meganyctiphanes norvegica*), and shrimp (*Pandalus borealis*). At the 120 m station, herring and small cod fed mainly on euphausiids. Because of diel vertical migrations, euphausiids are presumably close to the bottom during the day at this depth, and hence very susceptible to predation by both pelagic and benthic fishes. During the darkest period of the 24-hr day cod caught in midwater (50-70 m depth) had appreciable quantities of fresh euphausiids in their stomachs. At the 180 m station euphausiids were relatively unimportant in the food of cod caught in the bottom trawls but were numerous in cod caught in midwater trawls at depths of the 120 kHz sound scattering layer. The scattering layer did not impinge on the bottom at this station. It migrated from depths of about 150 m by day into the upper 100 m at night; both capelin and cod were associated with the layers. Although copepods were the most numerous type of prey in capelin stomachs from the 180 m station, euphausiids predominated volumetrically.

80-001333 Phillips, R. R. and S. B. Swears. SOCIAL HIERARCHY, SHELTER USE, AND AVOIDANCE OF PREDATORY TOADFISH (*OPSANUS TAU*) BY THE STRIPED BLENNY (*CHASMODES BOSQUIANUS*). *Anim. Behav. (Baillière Tindall, London)* 27(4):1113-1121. Nov. 1979. SFA 25(2)
[Dep. Biol., State Univ. Coll., Oneonta, NY 13820] This paper describes a three-part examination of the predatory relationship between oyster toadfish (*Opsanus tau*) and striped blennies (*Chasmodes bosquianus*). In the first laboratory study, blennies avoided the toadfish when placed in a choice situation. During the second laboratory study, dominant blennies escaped attack significantly more than did subordinates by using a protective shelter. A field study demonstrated that toad fish will attack active but tethered blennies under natural conditions. As predators, toadfish appear to use a mixed strategy. During the day, when they are relatively inactive, they may feed as ambush predators. However, we suggest that at night they move about actively, stalking benthic invertebrates and small fishes. They also feed as scavengers, consuming a variety of foods.

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80-001334 Portsev, P. I. THE FEEDING OF THE CUTLASSFISH, *TRICHIURUS LEPTURUS* (PISCES, TRICHIURIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):775-781. 1978. SFA 25(2)

[AzCherNIRO, Kerch, USSR] On the basis of dissected stomachs of cutlassfish data are presented characterizing its feeding off the coast of Oman. The food spectrum of the cutlassfish is composed of small demersal and pelagic fishes, Cephalopoda and crustaceans. Their main food is fish. The food composition of the cutlassfish does not vary noticeably in different seasons. The daily feeding rhythm during the summer period is examined. The reasons for a change in feeding intensity during the day are discussed. Data on the distribution of fish and of their food depth are presented.

80-001335 Robb, A. P. and J. R. G. Hislop. THE FOOD OF FIVE GADOID SPECIES DURING THE PELAGIC 0-GROUP PHASE IN THE NORTHERN NORTH SEA. *J. Fish Biol.* 16(2):199-217. Feb. 1980. SFA 25(2)

[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] The diets of five gadoid species in the northern North Sea are described: the cod, *Gadus morhua* (L.): haddock, *Melanogrammus aeglefinus* (L.): whiting, *Merlangius merlangus* (L.); saithe, *Pollachius virens* (L.); and the Norway pout, *Trisopterus esmarkii* (L.). The diet of each species was shown to be a gradual progression to different prey species as the predators increased in length. There were differences in the food taken by each species with respect to numbers, species and size. These differences in diet suggest that the degree of competition between pelagic 0-group gadoids is not great.

80-001336 Stickney, R. R. and R. B. McGeachin. FOOD HABITS OF FISHES ASSOCIATED WITH MARSHLAND DEVELOPED ON DREDGED MATERIAL. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:547-560. 1978[1979]. SFA 25(2)

[Dep. Wildl. Fish Sci., Tex. A&M Univ., College Station 77843] The food habits of *Micropogon undulatus, Leiostomus xanthurus, Fundulus similis, Cyprinodon variegatus, Menidia beryllina* and *Membras martinica* were studied in conjunction with the development of a man-made salt marsh planted during 1976 on Bolivar Peninsula, Galveston Bay, TX. Each of the fishes studied fed to a considerable extent on the benthos community, and utilized at least some zooplanktonic and terrestrial insect foods. The dominant food organisms in the fish stomachs examined corresponded, in general, with those previously reported by other investigators. The artificially created salt marsh on Bolivar Peninsula appeared to provide habitats, both for fishes and their foods, similar to those of natural marshland areas along the coasts of the Gulf of Mexico and the southeastern United States.

80-001337 Stoner, A. W. THE MACROBENTHOS OF SEAGRASS MEADOWS IN APALACHEE BAY, FLORIDA, AND THE FEEDING ECOLOGY OF *LAGODON RHOMBOIDES* (PISCES: SPARIDAE). *Ph.D. dissertation, Fla. State Univ.* 187p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4105. Mar. 1980. SFA 25(2)

80-001338 Tremblay, D. and G. J. Fitzgerald. SOCIAL ORGANIZATION AS AN ANTI-PREDATOR STRATEGY IN FISH. *Nat. Can. (Que.)* 106(3):411-413. May-June 1979. In English with French summ. SFA 25(2)

[Dep. Biol., Univ. Laval, Quebec G1K 7P4, Canada] The efficiency of a predator, the common piranha, *Serrasalmus spilopleura*, preying upon various densities of schooling zebra danios, *Brachydanio rerio*, and non-schooling goldfish, *Carassius auratus*, was evaluated as a function of prey density and distribution. The predator made more attacks and was significantly more successful against non-schooling than against schooling fish.

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80-001339 Wells, L. FOOD OF ALEWIVES, YELLOW PERCH, SPOTTAIL SHINERS, TROUT-PERCH, AND SLIMY AND FOURHORN SCULPINS IN SOUTHEASTERN LAKE MICHIGAN. *U.S. Fish Wildl. Serv. Tech. Pap.* 98. 12p. 1980. SFA 25(2)

Stomachs of 1,064 alewives (*Alosa pseudoharengus*), 1,103 yellow perch (*Perca flavescens*), 246 spottail shiners (*Notropis hudsonius*), 288 trout-perch (*Percopsis omiscomaycus*), 454 slimy sculpins (*Cottus cognatus*), and 562 fourhorn sculpins (*Myoxocephalus quadricornis*) from Lake Michigan were examined for food contents. Fish were sampled primarily from March to November and nearly all were caught at the bottom in the southeastern part of the lake near Saugatuck, Michigan. Depths of capture (m) were: alewives, 5 to 110; yellow perch, 5 to 26; spottail shiners, 5 to 31; trout-perch, 9 to 46; slimy sculpins, 31 to 91; and fourhorn sculpins, 73 to 110. Alewives, particularly those less than 140 mm long, fed chiefly on zooplankton: *Pontoporeia* usually constituted most of the rest of the food, although *Mysis* and immature midges were occasionally eaten in considerable quantity. Yellow perch ate primarily *Pontoporeia*, fish, fish eggs, *Mysis* and crayfish; *Pontoporeia* was consumed most heavily by perch less than 250 mm long and those in relatively deep water, fish (mainly slimy sculpins) by those 200 mm long or longer, *Mysis* by those in deep water, and crayfish by those on rocky bottom. Spottail shiners fed most commonly on immature midges, *Pontoporeia*, zooplankton, fingernail clams, and (in July only) fish eggs; immature midges were eaten mainly by shiners in shallow water; and *Pontoporeia* by those in deeper areas. The diet of trout-perch was strongly dominated by *Pontoporeia* and immature midges. Slimy sculpins ate *Pontoporeia* almost exclusively. Fourhorn sculpins fed almost entirely on *Mysis* and *Pontoporeia: Pontoporeia* was particularly important in the diet of the larger fish.

80-001340 Wilsman, L. A. RESOURCE PARTITIONING AND MECHANISMS OF CO-EXISTENCE OF BLACKCHIN AND BLACKNOSE SHINERS (*NOTROPIS*: CYPRINIDAE). *Ph.D. dissertation, Mich. State Univ.* 130p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4107. Mar. 1980. SFA 25(2)

[The results suggest that the greater success of the black-chin relative to the blacknose in Lawrence Lake may be due to its ability to opportunistically forage a wider range of habitats under low resource conditions. Predation is implicated both as an important constraint to ecological segregation by the shiners as well as an ameliorating factor to competition. The decline in food intake by the shiners across the summer, though, indicates that predation was not severe enough to maintain shiner populations below levels at which food was limiting.--From abstr.

80-001341 Zadorozhnaya, Ye. A. THE SEASONAL AND DIURNAL DYNAMICS OF THE FEEDING OF THE WHITE BREAM, *BLICCA BJOERKNA*, FROM MOZHAYSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):765-775. 1978. SFA 25(2)

[Dep. Ichthyol., Moscow Univ., USSR] The seasonal and diurnal dynamics of feeding of the white bream, *Blicca bjoerkna*, from Mozhaysk reservoir was studied under different annual hydrologic regimes. The qualitative composition of the food of the white bream is similar from year to year. Chironomidae larvae are the main food. When chironomid biomass is low white bream change over to feeding on the young of the ruffe, *Acerina cernua*, or on crustaceans. The white bream fed less intensively in years with low water level and water temperature. Data on rations and the composition of components from various trophic levels are presented.

80-001342 Zakora, L. P. THE FEEDING OF THE STERLET, *ACIPENSER RUTHENUS*, AND ITS UTILIZATION OF THE FOOD RESOURCES OF VOLGOGRAD RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):946-952. 1978. SFA 25(2)

[Saratov Dep., State Res. Inst. Lake River Fish., USSR] Long-term data on the feeding of the sterlet, *Acipenser ruthenus*, in Volgograd reservoir were analyzed. On the basis of changes in the annual rations and food

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80-001342 CONTINUED coefficients, an assessment is given of the food supply to the population during different times of the existence of the reservoir. Data are presented on the degree of utilization by the sterlet of plankton and benthos production. It is shown that favorable conditions have been created in the reservoir for the feeding of the sterlet. In order to increase the abundance of the sterlet, the release of its young into the most eutrophic arms of the reservoir is recommended.

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80-001343 Nævdal, G.; M. Holm; R. Lerøy and D. Møller. INDIVIDUAL GROWTH RATE AND AGE AT SEXUAL MATURITY IN RAINBOW TROUT. *Fiskeridir. Skr. Ser. Havunders.* 17(1):1-10. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway]

80-001344 Nævdal, G.; Ø. Bjerk; M. Holm; R. Lerøy AND D. Møller. GROWTH RATE AND AGE AT SEXUAL MATURITY OF ATLANTIC SALMON SMOLTIFYING AGED ONE AND TWO YEARS. *Fiskeridir. Skr. Ser. Havunders.* 17(1):11-17. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway]

80-001345 Adelman, I. R. UPTAKE OF ^{14}C-GLYCINE BY SCALES AS AN INDEX OF FISH GROWTH: EFFECT OF FISH ACCLIMATION TEMPERATURE. *Trans. Am. Fish. Soc.* 109(2):187-194. Mar. 1980. SFA 25(2)
[Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul 55108]

80-001346 Bowen, S. H. DETRITAL NONPROTEIN AMINO ACIDS ARE THE KEY TO RAPID GROWTH OF *TILAPIA* IN LAKE VALENCIA, VENEZUELA. *Science* 207(4436):1216-1218. 14 Mar. 1980. SFA 25(2)
[Dep. Biol. Sci., Mich. Technol. Univ., Houghton 49931] The detritivorous cichlid *Sarotherodon mossambicus* grows rapidly on a low-protein diet by assimilating detrital nonprotein amino acids. Differences in the quantity of detrital amino acids in different lakes may account for the variable success of *S. mossambicus* introductions around the world.

80-001347 Budnichenko, V. A. and L. A. Nor. SOME FEATURES OF THE GROWTH OF *SAURIDA UNDOSQUAMIS* AND *S. TUMBIL* (PISCES, SYNODONTIDAE) IN THE ARABIAN SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):750-755. 1978. SFA 25(2)
[AzCherNIRO, Kerch, USSR]

80-001348 Catchings, E. D. AGE AND GROWTH OF REDEYE BASS IN SHOAL AND LITTLE SHOAL CREEKS, ALABAMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:380-390. 1978[1979]. SFA 25(2)
[Ala. Dep. Conserv. Nat. Resour., Game Fish Div., Eastaboga, 36260] The age and growth of redeye bass (*Micropterus coosae*) in Shoal Creek and Little Shoal Creeks, Alabama, were determined. Shoal Creek redeye bass, on the average, grew faster than redeye bass in other studies. Little Shoal Creek redeye bass grew slower during the first 6 years of life than redeye bass in other areas with the exception of redeye bass in Sheed's Creek, TN; however,

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80-001348 CONTINUED by age VII Little Shoal Creek redeye bass were slightly larger than Shoal Creek redeye bass. Condition factors (K_n) of Shoal and Little Shoal Creek redeye bass relative to Alabama state wide averages for redeye bass and to redeye bass from other waters were computed. The redeye bass from Shoal and Little Shoal Creeks were in poorer condition relative to the average for Alabama redeye bass and to redeye bass in other waters. The condition of redeye bass in Shoal and Little Shoal Creeks improved as the fish grew relative to redeye bass in other waters.

80-001349 Eiras, J. C. and S. Carrasa. NOTE SUR LA BIOLOGIE DE *MUGIL CEPHALUS* (L.) DU NORD DU PORTUGAL: VARIATIONS ANNUELLES DES RAPPORTS POIDS-LONGUEUR, DU RAPPORT HÉPATOSOMATIQUE ET DU COEFFICIENT DE CONDITION. [NOTE IN THE BIOLOGY OF *MUGIL CEPHALUS* (L.) FROM NORTHERN PORTUGAL: ANNUAL VARIATIONS IN LENGTH-WEIGHT RELATIONSHIPS, HEPATOSOMATIC RELATIONSHIP AND COEFFICIENT OF CONDITION. *Nat. Can. (Que.)* 106(3):415-419. May-June 1979. In French. SFA 25(2)

[Inst. Zool. "Dr. Augusto Nobre" Fac. Cienc., Porto, Portugal]

80-001350 Guier, C. R.; W. G. Miller; A. W. Mullis and L. E. Nichols. COMPARISON OF GROWTH RATES AND ABUNDANCE OF LARGEMOUTH BASS IN SELECTED NORTH CAROLINA COASTAL RIVERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:391-400. 1978[1979]. SFA 25(2)

[N.C. Wildl. Resour. Comm., Div. Inland Fish., 512 N. Salisbury St., Raleigh 27611] Age-growth relationships, length-weight relationships, and relative abundance indices were determined for largemouth bass (*Micropterus salmoides*) collected from the Cape Fear, Chowan, Pasquotank and Tar-Pamlico river systems in North Carolina during 1976. Largemouth bass in the Pasquotank River had the highest mean annual growth rate during their first and second years when compared to those in the other river systems studied. Largemouth in the Tar-Pamlico River system had the highest mean annual growth rates for age groups III and older. The growth rate of the Chowan River largemouth population was intermediate between those of the Pasquotank and the Tar-Pamlico rivers, while populations in the Cape Fear River had the slowest growth. Largemouth bass in the Chowan, Pasquotank, and Tar-Pamlico rivers attain legal harvestable size and recruit into the fishery at 305 mm in total length during their fourth growing season. The Cape Fear River largemouth population did not reach this harvestable size and until the fifth growing season. Largemouth bass were found in order of decreasing abundance in the Chowan, Cape Fear, Tar-Pamlico, and Pasquotank rivers.

80-001351 Hart, J. L. AGE AND GROWTH OF THE BLUEGILL, *LEPOMIS MACROCHIRUS* RAFINESQUE, IN A NEWLY IMPOUNDED FARM POND. *Trans. Kans. Acad. Sci.* 82:211-217. 1979. SFA 25(2)

[Box 626, Winfield, KS 67156] Rate of growth of 589 bluegills, *Lepomis macrochirus* Rafinesque, collected in 1974 and 1975 from a farm pond in northwestern Kansas, was determined by the scale method. The body-scale relationship was linear with an intercept of 18.0519 mm total length. The length-weight relationship was described by the equation $W = 6.19 \times 10^{6} L^{3.2327}$. Annulus formation began in late April and was completed by early June. Average total lengths were 37 mm, 101 mm, 159 mm and 164 mm for ages I through IV respectively. The growth rate was generally greater than in other areas of the central states. Males outnumbered females in the sample, but this appeared to result from sampling bias rather than from unequal sex ratios. Males averaged longer than females in all age groups, but the difference was significant only in the fourth year of growth. Spawning was 80 percent complete by late May.

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80-001352 Jayaprakash, A. A. AGE AND GROWTH OF THE JUVENILES OF KOTH *OTOLITHOIDES BRUNNEUS* (DAY) IN BOMBAY WATERS. *Indian J. Fish.* 23(1/2):86-96. 1976. SFA 25(2)

[Bombay Res. Cent., C.M.F.R. Inst., Bombay-1, India] The age and growth of juveniles of 'Koth', *Otolithoides brunneus* (Day), were determined by three methods; 1) length-frequency distribution 2) scales 3) otoliths. The length attained at the completion of I to IV years of life as deduced from the length-frequency studies were 40.0, 60.0, 80.0 and 95.0 cm, respectively. The corresponding length calculated from scales for the same were found to be 40.7, 57.8, 75.6 and 91.3 cm. By the time the scales develop one ring the otoliths showed three 'larval rings'. The period of formation of the first scale ring corresponds to that of the fourth ring in the otoliths. The period of formation of the rings in the scales was found to coincide with the winter months, October to February. The formation of the rings may be due to low temperature prevailing during this period. The value of L_∞ obtained by using Walford's growth transformation is 198 cm. The K and L_∞ values estimated by von Bertalanffy equation were 0.14 and 206.4 cm respectively.

80-001353 Kerby, J. H. and E. B. Joseph. GROWTH AND SURVIVAL OF STRIPED BASS X WHITE PERCH HYBRIDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:715-726. 1978[1979]. SFA 25(2)

[Va. Inst. Mar. Sci., Gloucester Point, VA 23062] Experiments comparing growth and survival of striped bass (*Morone saxatilis*) and striped bass female X white perch (*M. americana*) male hybrids indicated the hybrids were hardier than striped bass under the same experimental conditions. Striped bass exhibited health problems and resulting mortality which were not evident in the hybrids. Overall survival of striped bass in 2 replicate experiments was 42.5% agter 11 months, whereas that of the hybrids was 84.2%. Striped bass and hybrid growth patterns were similar, but striped bass grew more rapidly than the latter. Mean specific (instantaneous) growth rates were roughly similar throughout the study, with the major differences occurring during the first 4 months. At 17 months of age the mean hybrid fork length was 227.5 mm (range, 167 to 282 mm). This length was approximately equivalent to that of wild populations of white perch with 4 to 8 annuli and to that of mid-Atlantic striped bass with 2 annuli, but was substantially less than that of fresh-water and more southern populations. Hybrid length-weight equations were intermediate between those of striped bass and white perch. Salinity experiments demonstrated that both small (mean fork length, 43 mm) and large (mean fork length, 279 mm) hybrids can survive and grow for indefinite periods at salinities of 18 to 25 °/oo with no signs of stress. We believe that the hybrid may be suitable as a supplement to natural populations of striped bass and white perch in estuaries.

80-001354 Kingsley, M. C. S.; V. F. Gallucci and T. J. Quinn II. VON BERTALANFFY GROWTH PARAMETERS. *Trans. Am. Fish. Soc.* 109(2):252-253. Mar. 1980. SFA 25(2)

[Can. Wildl. Serv., 9942-108 St., Edmonton, AB T5K 2J5, Canada]

80-001355 Magnin, É. and A.-M. Clément. CROISSANCE ET RÉGIME ALIMENTAIRE DES MÉNOMINIS RONDS *PROSOPIUM CYLINDRACEUM* (PALLUS) DU TERRITOIRE DE LA BAIE JAMES. [GROWTH AND FOOD HABITS OF ROUND WHITEFISH *PROSOPIUM CYLINDRACEUM* (PALLAS) FROM THE JAMES BAY AREA.] *Nat. Can. (Que.)* 106(3):377-386. May-June 1979. In French with English summ. SFA 25(2)

[Dep. Sci. Biol., Univ. Montréal, C.P. 6128, Montréal, H3C 3J7, Canada] Ages were determined by examination of scales from 598 specimens of *Prosopium cylindraceum*: 93 from the lower part of the Grande riviére de la Baleine, 367 from the middle and lower reaches of the Grande Riviére and 138 from the upper parts of these two rivers and the adjacent Caniapiscau River. Growth in fork length and weight is very slow in

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80-001355 CONTINUED the Caniapiscau area, a little faster in La Grande Rivière and fastest in the Grande rivière de la Baleine: at age 10, 275 mm (206 g), 325 mm (355 g) and 344 mm (421 g) respectively. Round whitefish from the La Grande Rivière estuary fed mainly on insect larvae, principally those of Trichoptera and Diptera (Chironomidae).

80-001356 Mills, K. H. and R. J. Beamish. COMPARISON OF FIN-RAY AND SCALE AGE DETERMINATIONS FOR LAKE WHITEFISH (*COREGONUS CLUPEAFORMIS*) AND THEIR IMPLICATIONS FOR ESTIMATES OF GROWTH AND ANNUAL SURVIVAL. *Can. J. Fish. Aquatic Sci.* 37(3):534-544. Mar. 1980. SFA 25(2)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

80-001357 Narasimham, K. A. AGE AND GROWTH OF RIBBONFISH *TRICHIURUS LEPTURUS* LINNAEUS. *Indian J. Fish.* 23(1/2):174-182. 1976. SFA 25(2)
[Kakinada Res. Cent. C.M.F.R. Inst., Kakinada-533002, India] Age and growth of the ribbonfish *Trichiurus lepturus* Linnaeus is studied by length-frequency analysis of 20,562 fish measured during October 1965 to December 1970. The fish attains an average length of 41.6, 69.0 and 88.5 cm in 1st, 2nd, and 3rd years, respectively. The growth rate is fairly faster than what hitherto believed was to be. The von Bertalanffy growth equation is fitted, which has the parameters L_∞=145.4 cm, K=0.29 and t_0=-0.20 years. The length-at-age data obtained in this study compare favourably well with similar data on the same species from the northern Gulf of Mexico, East China Sea and Yellow Sea-Pohai Bay.

80-001358 Roff, D. A. A MOTION FOR THE RETIREMENT OF THE VON BERTALANFFY FUNCTION. *Can. J. Fish. Aquatic Sci.* 37(1):127-129. Jan. 1980. In English with French summ. SFA 25(2)
[Fish. Mar. Serv., P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-001359 Sanders, M. J. and D. G. M. Powell. COMPARISON OF THE GROWTH RATES OF TWO STOCKS OF SNAPPER (*CHRYSOPHRYS AURATUS*) IN SOUTH-EAST AUSTRALIAN WATERS USING CAPTURE-RECAPTURE DATA. *N.Z. J. Mar. Freshwater Res.* 13(2):279-284. 1979. SFA 25(2)
[Arthur Rylah Inst. Environ. Res., Fish. Wildl. Div., Minist. Conserv., Brown St., Heidelberg, Victoria, Australia 3084] Between 1957 and 1962, 4155 snapper, *Chrysophrys auratus* (Bloch & Schneider), were tagged and released at a number of sites in Victoria. By the end of June 1972, 210 had been recaptured, and knowing their lengths at release and recapture and the periods at liberty, we determined the von Bertalanffy growth parameters K and L_∞. The values (with 95% confidence limits) were: eastern stock - K = 0.071 ± 0.040, L_∞ = 968 ± 325 mm; western stock - K = 0.068 ± 0.023, L_∞ = 1079 ± 209 mm; combined stocks - K = 0.062 ± 0.019, L_∞ = 1119 ± 215 mm. No difference between the stocks was apparent when we compared the estimates of K and L_∞ separately; however, when the estimates of K and L_∞ were compared together, a Wilcoxon's test gave a significance probability of 1.5%, indicating a difference in growth rate between the stocks. For the range of lengths of snapper recaptured, this difference was evidently caused by faster growth of snapper from the western stock.

AGE AND GROWTH

80-001360 Schmitt, D. N. and W. A. Hubert. COMPARISON OF TWO AGING TECHNIQUES FOR YELLOW PERCH. *Proc. Iowa Acad. Sci.* 87(1):12. Mar. 1980. Abstract only. SFA 25(2)

[Iowa Coop. Fish. Res. Unit, Iowa State Univ., Ames 50011] Estimating fish population parameters from age and growth data is dependent upon the precision of age determination. Assessment of the precision of aging techniques utilizing body scales and cleithral bones was conducted on a sample of 100 yellow perch, (*Perca flavescens*), from West Okoboji Lake, Iowa. Regressions on total length using scale and cleithral measurements were compared and backcalculation of annual mean lengths were computed. Aging methods agreed on 95 percent of the sample. Cleithral bones were useful in substantiating scale readings from acetate impressions, but did not significantly improve precision of aging. Extra time needed for collection and preparation of cleithra and the necessary sacrifice of sampled perch probably limits applicability of the cleithral method.

80-001361 Short, D. W. and B. J. Davis. PRELIMINARY OBSERVATIONS OF AGE AND GROWTH BY *POMOXIS ANNULARIS* AND *P. NIGROMACULATUS* IN NORTH LOUISIANA. *Proc. La. Acad. Sci.* 42:84. 1979. Abstract only. SFA 25(2)

[La. Polytech. Univ., Ruston]

80-001362 Shust, K. V. and I. A. Pinskaya. AGE AND RATE OF GROWTH OF SIX SPECIES OF NOTOTHENID FISH (FAMILY NOTOTHENIIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):743-749. 1978. SFA 25(2)

[VNIRO, Moscow, USSR]

80-001363 Timmons, T. J.; W. L. Shelton and W. D. Davis. DIFFERENTIAL GROWTH OF LARGEMOUTH BASS IN WEST POINT RESERVOIR, ALABAMA-GEORGIA. *Trans. Am. Fish. Soc.* 109(2):176-186. Mar. 1980. SFA 25(2)

[Ala. Coop. Fish. Res. Unit, Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

80-001364 Weatherley, A. H.; H. S. Gill and S. C. Rogers. GROWTH DYNAMICS OF MUSCLE FIBRES, DRY WEIGHT, AND CONDITION IN RELATION TO SOMATIC GROWTH RATE IN YEARLING RAINBOW TROUT (*SALMO GAIRDNERI*). *Can. J. Zool.* 57(12):2385-2392. Dec. 1979. In English with French summ. SFA 25(2)

[Life Sci. Div., Scarborough Coll., Univ. Toronto, West Hill, ON M1C 1A4, Canada] Rainbow trout (15.5 cm) fed "ad lib." rations grew a little faster at 12°C than at 16°C, and both groups grew much faster than a third group at 12°C receiving "3-4%" rations. Growth of the mosaic muscle mass was characterized by increase in fibre mean diameter, though most bulk increase (up to 25 cm or more) resulted from increase in fibre number. Fibre diameter: fish length was least in the fastest growing trout (12°C ad lib.), signifying their greater ability to add new fibres during growth compared with the slower growing trout; diameter range increased markedly among trout >18 cm long, but small fibres (<20µm) persisted in diminishing numbers even in the largest trout. In the 12°C ad lib. trout, condition (K) correlated with length and fibre diameter; in the slower growing groups K was more influenced by mean fibre diameter. A higher asymptote of K occurred at greater length in the fastest growing group than in the two slower growing groups. Percent dry weight:length was greater for 16°C ad lib. than for the fastest or slowest growth groups; absolute dry weight:length ratios were similar for 12°C and 16° ad lib. trout; both exceeded those for the 12°C 3-4% group.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001365 Adkins, G.; J. Tarver; P. Bowman and B. Savoie. A STUDY OF THE COMMERCIAL FINFISH IN COASTAL LOUISIANA. *La. Dep. Wildl. Fish. Tech. Bull.* No. 29. viii + 87p. July 1979. SFA 25(2)

80-001366 Anonymous. ENDEMIC FISHES OF THE COLORADO RIVER SYSTEM A STATUS REPORT. *Colo. River Wildl. Counc. Publ.* 16p. 1 May 1977. SFA 25(2)

80-001367 Baranes, A. and A. Ben-Tuvia. TWO RARE CARCHARHINIDS, *HEMIPRISTIS ELONGATUS* AND *IAGO OMANENSIS*, FROM THE NORTHERN RED SEA. *Isr. J. Zool.* 28(1):39-50. 1979. SFA 25(2)
[Dep. Zool., Hebrew Univ. Jerusalem, Jerusalem, Israel] Two rare species of sharks of the family Carcharhinidae have been collected in the Gulf of Elat (= Gulf of 'Aqaba), northern Red Sea. A description of *Hemipristis elongatus* (Klunzinger, 1871) is based on one specimen, with additional data based on a specimen collected in the Gulf of Oman; a description of *Iago omanensis* (Norman, 1939) is based on four specimens caught at a depth of 500-1000 m. This is the first record of this species from the Red Sea although it seems that photographs of specimens resting on the bottom at great depths were published by Marshall and Bourne in 1964.

80-001368 Bohnsack, J. A. RESOLUTION OF THE ORDER VERSUS CHAOS CONTROVERSY CONCERNING REEF FISH COMMUNITY STRUCUTRE IN TERMS OF ISLAND BIOGEOGRPAHIC THEORY. *Fla. Sci.* 43(Suppl. 1):23. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Miami, Coral Gables, FL 33155] Two prominent schools have developed concerning reef fish community structure. According to the order (deterministic) school, reef fishes have evolved precise habitat requirements which reduce competition for limited resources. This results in reef fish communities that tend to be stable through time. According to the chaos (Stochastic) school, reef fish communities are quite unstable in structure because of high mortality rates which are largely determined by chance processes. Data on reef fish turnover rates collected from model and natural coral heads in the Florida Keys over 3 years suggest that the dichotomy of views is an artifact of interval between samples and can be accounted for in terms of island biogeographic theory. The Y-intercept of the log of estimated turnover rate versus the log of time between samples is suggested as an objective basis for comparing turnover rates.

80-001369 Briggs, P. T.; C. S. Zawacki and F. M. Mushacke. NOTES ON FISHES RARE IN THE WATERS OFF THE SOUTH SHORE OF LONG ISLAND. *N.Y. Fish Game J.* 26(2):195-197. July 1979. SFA 25(2)
[State Univ. N.Y., Environ. Conserv., Bldg. 40, Stony Brook 11794]

80-001370 Campbell, R. N. and R. B. Williamson. THE FISHES OF INLAND WATERS IN THE OUTER HEBRIDES. *Proc. R. Soc. Edinburgh Sect. B Biol. Sci.* 77:377-393. 1979. SFA 25(2)
[Nat. Conserv. Council, Fraser Darling House, Inverness, Scotland]

80-001371 Carlson, C. A.; C. G. Prewitt; D. E. Snyder; E. J. Wick; E. L. Ames and W. D. Fronk. FISHES AND MACROINVERTEBRATES OF THE WHITE AND YAMPA RIVERS, COLORADO. *U.S. Dep. Interior Bur. Land Manage. (Colo.) Biol. Sci. Ser.* No. 1. ix + 276p. Feb. 1979. SFA 25(2)
[Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins 80523]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001372 Carlson, H. R. SEASONAL DISTRIBUTION AND ENVIRONMENT OF PACIFIC HERRING NEAR AUKE BAY, LYNN CANAL, SOUTHEASTERN ALASKA. *Trans. Am. Fish. Soc.* 109(1):71-78. Jan. 1980. SFA 25(2)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

80-001373 Clark, T. FISHES OF THE MOUTH OF WOLF RIVER, DONIPHAN COUNTY, KANSAS. *Trans. Kans. Acad. Sci.* 82:188-193. 1979. SFA 25(2)
[Bendena, KS 66008]

80-001374 Comp, G. S. PATTERNS OF SEASONALITY AND RELATIVE ABUNDANCE OF FISHES IN EASTERN TAMPA BAY. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)
[Mote Mar. Lab., 1600 City Island Park, Sarasota, FL 33577]

80-001375 Davis, J. R. REDISCOVERY, DISTRIBUTION, AND POPULATIONAL STATUS OF *CYPRINODON EXIMIUS* (CYPRINODONTIDAE) IN DEVIL'S RIVER, TEXAS. *Southwest. Nat.* 25(1):81-88. 30 Jan. 1980. SFA 25(2)
[Tex. Dep. Water Resour., P.O. Box 13087, Capitol Stn., Austin 78711] Recent collections of *Cyprinodon eximius* from Devil's River, the first in 10 years, have dispelled reports of its extinction there. However, populational status is precarious due to severe habitat loss and range restriction. Distributional data and ongoing morphological observations suggest that two allopatric populations once inhabited the river. A population that once occurred above Dolan Falls is now extinct, apparently a victim of a series of catastrophic events in the mid-1950's. A second population originally inhabited lower Devil's River and an immediately adjacent portion of the Rio Grande, but the filling of Amistad Reservoir in 1968 inundated over 75% of that reach. Now, only a remnant of the second population survives, restricted to a 10.9 km reach above Amistad Reservoir.

80-001376 Fiske, J. D.; C. E. Watson and P. G. Coates. A STUDY OF THE MARINE RESOURCES OF PLEASANT BAY. *Mass. Dep. Nat. Resour. Div. Mar. Fish. Monogr. Ser.* No. 5. iii + 56p. May 1967. SFA 25(2)

80-001377 Friedman, B. and C. T. Hamilton. THE FISH LIFE OF UPPER NEW YORK BAY. *Underwater Nat.* 12(2):18-21. 1980. SFA 25(2)
[Texas Instruments, Buchanan, NY]

80-001378 Galzin, R. LA FAUNE ICHTHYOLOGIQUE D'UN RECIF CORALLIEN DE MOOREA, POLYNESIE FRANÇAISE: ECHANTILLONNAGE ET PREMIERS RESULTATS. [THE FISH COMMUNITY OF A CORAL REEF OF MOOREA, FRENCH POLYNESIA: SAMPLING TECHNIQUES AND PRELIMINARY RESULTS.] *Terre Vie* 33(4):623-643. Oct.-Dec. 1979. In French with English summ. SFA 25(2)
[Antenne Mus. Hautes Etudes, B.P. 562 Papeete, Tahiti]

80-001379 Gosselink, J. G.; C. L. Cordes and J. W. Parsons. AN ECOLOGICAL CHARACTERIZATION STUDY OF THE CHENIER PLAIN COASTAL ECOSYSTEM OF LOUISIANA AND TEXAS. VOLUME I. NARRATIVE REPORT. *U.S. Fish Wildl. Serv.* FWS/OBS-78/9. xxiv + 302p. Aug. 1979. SFA 25(2)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

80-001380 Gosselink, J. G.; C. L. Cordes and J. W. Parsons. AN ECOLOGICAL CHARACTERIZATION STUDY OF THE CHENIER PLAIN COASTAL ECOSYSTEM OF LOUISIANA AND TEXAS. VOLUME II. APPENDIXES. *U.S. Fish Wildl. Serv.* FWS/OBS-78/10.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001380 CONTINUED ix + 407p. Aug. 1979. SFA 25(2)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

80-001381 Gosselink, J. G. AN ECOLOGICAL CHARACTERIZATION STUDY OF THE CHENIER PLAIN COASTAL ECOSYSTEM OF LOUISIANA AND TEXAS. VOLUME III. ATLAS. *U.S. Fish Wildl. Serv.* FWS/OBS-78/11. Aug. 1979. SFA 25(2)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

80-001382 Guillory, V. A POSSIBLE EXPLANATION FOR THE ABSENCE OF ENDEMIC FISHES IN LOUISIANA. *Fla. Sci.* 42(4):253-255. 1979. SFA 25(2)
[Fla. Game Fresh Water Fish Comm., P.O. Box 1903, Eustis 32726] The absence of endemic Louisiana fishes may be attributed to historical and physiographic factors. The periodic inundation of the Mississippi Embayment by the Gulf of Mexico during early Pleistocene interglacial periods obliterated the freshwater ichthyofauna. Afterwards, the ample dispersal mechanisms available prevented isolation and subsequent speciation of fishes in Louisiana.

80-001383 Guillory, V. DISTRIBUTIONAL NOTES ON SOME LOWER MISSISSIPPI RIVER FISHES. *Fla. Sci.* 42(4):248-250. 1979. SFA 25(2)
[Fla. Game Fresh Water Fish Comm., P.O. Box 1903, Eustis 32726] The fishes were collected for the first time in Louisiana during recent ecological investigations in the Mississippi River. The known ranges of *Hybopsis gelida*, *H. meekei* and *Noturus flavus* were extended 1125, 642, and 370 river km, respectively.

80-001384 Guillory, V.; C. H. Hocutt and J. R. Stauffer, Jr. ENDANGERED FRESHWATER FISHES OF THE SOUTHEASTERN UNITED STATES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:703-714. 1978[1979]. SFA 25(2)
[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle] Endangered native freshwater fishes are catalogued for 16 southeastern states. The status of each of the 356 species is included at the national, regional, or state levels. A standardized list of categories (endangered; threatened; special concern - national; special concern - state; extirpated) and definitions are suggested for use in state programs. Further recommendations are made to base programs on the state level on sound and manageable endangered species checklists.

80-001385 Hadley, W. F. and K. Clulow. FIRST RECORD OF THE FALLFISH FROM THE LAKE ERIE DRAINAGE OF NEW YORK. *N.Y. Fish Game J.* 26(2):192-193. July 1979. SFA 25(2)
[Dep. Biol., State Univ. N.Y., Buffalo]

80-001386 Halliwell, D. B. A LIST OF THE FRESHWATER FISHES OF MASSACHUSETTS. *Mass. Div. Fish. Wildl. Fauna Mass. Ser.* No. 4. 13p. 1979. SFA 25(2)

80-001387 Hastings, R. W. THE ORIGIN AND SEASONALITY OF THE FISH FAUNA ON A NEW JETTY IN THE NORTHEASTERN GULF OF MEXICO. *Bull. Fla. State Mus. Biol. Sci.* 24(1):1-124. 1979. SFA 25(2)
[Dep. Biol., Rutgers Univ., Camden, NJ]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001388 Hempel, G.; D. Sahrhage; W. Schreiber and R. Steinberg. ANTARKTIS-EXPEDITION 1977/78 DER BUNDESREPUBLIK DEUTSCHLAND. [ANTARCTIC EXPEDITION 1977/78 OF THE FEDERAL REPUBLIC OF GERMANY.] *Arch. Fischereiwiss.* 30(1):1-119. Oct. 1979. In German with English summ. SFA 25(2)
[Inst. Meereskd., Univ. Kiel, West Germany]

80-001389 Hewitt, R. P. and P. Smith. SEASONAL DISTRIBUTIONS OF EPIPELAGIC FISH SCHOOLS AND FISH BIOMASS OVER PORTIONS OF THE CALIFORNIA CURRENT REGION. *Calif. Coop. Oceanic Fish. Invest.* 20:102-110. Oct. 1979. SFA 25(2)
[NMFS, Southwest Fish. Cent., P.O. Box 271, La Jolla 92038]

80-001390 Hislop, J. R. G. PRELIMINARY OBSERVATION ON THE NEAR-SURFACE FISH FAUNA OF THE NORTHERN NORTH SEA IN LATE AUTUMN. *J. Fish Biol.* 15(6):697-704. Dec. 1979. SFA 25(2)
[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

80-001391 Holton, G. THE RIDDLE OF EXISTENCE: FISHES OF "SPECIAL CONCERN". *Mont. Outdoors* 11(1):2-6, 26. Jan.-Feb. 1980. SFA 25(2)
[Mont. Dep. Fish Wildl. Parks, 1420 E. 6th, Helena 59601]

80-001392 Howe, K. M.; D. L. Stein and C. E. Bond. FIRST RECORDS OFF OREGON OF THE PELAGIC FISHES *PARALEPIS ATLANTICA, GONOSTOMA ATLANTICUM*, AND *APHANOPUS CARBO*, WITH NOTES ON THE ANATOMY OF *APHANOPUS CARBO*. *NOAA Fish. Bull.* 77(3):700-703. July 1979. SFA 25(2)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

80-001393 James, G. D. and G. Habib. FIRST RECORD OF AUSTRALIAN BONITO, *SARDO AUSTRALIS*, FROM NEW ZEALAND. *N.Z. Mar. Freshwater Res.* 13(3):425-426. 1979. SFA 25(2)
[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19062, Wellington, New Zealand]

80-001394 Jerome, W. C., Jr.; A. P. Chesmore and C. O. Anderson, Jr. A STUDY OF THE MARINE RESOURCES OF BEVERLY-SALEM HARBOR. *Mass. Dep. Nat. Resour. Div. Mar. Fish. Monogr. Ser.* No. 4. iii + 74p. Mar. 1967. SFA 25(2)

80-001395 Karasev, G. L. THE DISCOVERY OF SILVER CARP, *HYPOPHTHALMICHTHYS MOLITRIX*, IN THE ARGUN RIVER BASIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):852-854. 1978. SFA 25(2)
[Baikal Dep., Siberian Fish. Res. Plan Inst., Ulan Ude, USSR]

80-001396 Lindquist, D. G. and C. A. Harris. SUMMER FISH POPULATIONS ON A NEARSHORE ROCK OUTCROP IN ONSLOW BAY, NORTH CAROLINA. *J. Elisha Mitchell Sci. Soc.* 94(2):112-113. 1978. SFA 25(2)

80-001397 Lindquist, D. G.; J. R. Shute and P. W. Shute. RECENT RECORD OF THE BANDED KILLIFISH, *FUNDULUS DIAPHANUS* (LESUEUR), IN SOUTHEASTERN NORTH CAROLINA. *J. Elisha Mitchell Sci. Soc.* 94(2):113. 1978. Abstract only. SFA 25(2)

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001398 Lindquist, D. G.; H. M. Anderson and T. H. Handsel. NEW RECORDS OF TROPICAL SHORE FISHES FOR NORTH CAROLINA. *J. Elisha Mitchell Sci. Soc.* 94(2):113-114. 1978. Abstract only. SFA 25(2)

80-001399 Lipton, D. W. and J. G. Travelstead. BEACH ZONE FISH COMMUNITY STRUCUTURE IN THE JAMES RIVER, VIRGINIA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:639-647. 1978[1979]. SFA 25(2)
[Va. Inst. Mar. Sci., Gloucester Point 23062] A seining survey of the fish fauna of the beach zone in the James River, Virginia, was conducted from July to December 1977. Weekly collections were made at 4 stations resulting in the capture of 17,602 individuals representing 36 species. Abundance and diversity were influenced by large catches of schooling and migratory species utilizing nearshore areas as a nursery ground. Freshwater species diversity peaked in August and September, while mesohaline species diversity peaked in July, September, and November. Cluster analysis was used to define 3 freshwater station groups representing warm, moderate, and cool water temperatures, but was not helpful in analyzing mesohaline stations.

80-001400 Markle, D. F. and W. B. Scott. NEW AND RARE RECORDS OF CANADIAN FISHES AND THE INFLUENCE OF HYDROGRAPHY ON RESIDENT AND NONRESIDENT SCOTIAN SHELF ICHTHYOFAUNA. *Can. J. Fish. Aquatic Sci.* 37(1):49-65. Jan. 1980. In English with French summ. SFA 25(2)
[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada]

80-001401 Maughan, O. E.; E. E. Edmundson; A. E. Farris and R. L. Wallace. A COMPARISON OF FISH SPECIES ABOVE AND BELOW PALOUSE FALLS, PALOUSE RIVER, WASHINGTON-IDAHO. *Northwest Sci.* 54(1):5-8. Feb. 1980. SFA 25(2)
[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater 74074] Fish species above and below Palouse Falls did not differ greatly. Exotics above the falls are due to planting. Multiple invasions of cottid species are indicated by exclusion of recent invaders.

80-001402 Maurer, D. and J. C. Tinsman. DEMERSAL FISH IN DELAWARE COASTAL WATERS. *J. Nat. Hist.* 14(1):65-77. Jan.-Feb. 1980. SFA 25(2)
[Coll. Mar. Stud., Univ. Del., Newark]

80-001403 McAda, C. W.; C. R. Berry, Jr. and C. E. Phillips. DISTRIBUTION OF FISHES IN THE SAN RAFAEL RIVER SYSTEM OF THE UPPER COLORADO RIVER BASIN. *Southwest. Nat.* 25(1):41-50. 30 Jan. 1980. SFA 25(2)
[U.S. FWS, 1311 Federal Bldg., Salt Lake City, UT 84138]

80-001404 Mearns, A. J. ABUNDANCE, COMPOSITION, AND RECRUITMENT OF NEARSHORE FISH ASSEMBLAGES ON THE SOUTHERN CALIFORNIA MAINLAND SHELF. *Calif. Coop. Oceanic Fish. Invest.* 20:111-119. Oct. 1979. SFA 25(2)
[South. Calif. Coast. Water Res. Proj., 1500 East Imperial Highway, El Segundo 90245]

80-001405 Minckley, C. O. and S. W. Carothers. RECENT COLLECTIONS OF THE COLORADO RIVER SQUAWFISH AND RAZORBACK SUCKER FROM THE SAN JUAN AND COLORADO RIVERS IN NEW MEXICO AND ARIZONA. *Southwest. Nat.* 24(4):686-687. 10 Dec. 1979. SFA 25(2)
[Mus. North. Ariz., Rt. 4, Box 720, Flagstaff 86001]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001406 Minckley, W. L.; D. A. Hendrickson and D. J. Siebert. ADDITIONAL RECORDS FOR THE PACIFIC GIZZARD SHAD, *DOROSOMA SMITHI* (CLUPEIDAE), FROM SONORA, MÉXICO. *Southwest. Nat.* 24(4):695-697. 10 Dec. 1979. SFA 25(2)
[Dep. Zool., Ariz. State Univ., Tempe 85281]

80-001407 Mizera, J. J.; C. L. Cooper and C. E. Herdendorf. NEARSHORE ICHTHYOPLANKTON DENSITIES IN THE WESTERN BASIN OF LAKE ERIE-1977. *Ohio J. Sci.* 80:14. 1980. Abstract only. SFA 25(2)
[Cent. Lake Erie Area Res., Ohio State Univ., Columbus 43210]

80-001408 Moertly, R. J. TRAWL AND WING-NET STUDY OF FISH FAUNA OF CAMINADA BAY, LOUISIANA. *Proc. La. Acad. Sci.* 42:83. 1979. Abstract only. SFA 25(2)

80-001409 Murty, A. V. S. and M. N. Vishnudatta. THE SEASONAL DISTRIBUTION OF SOME OCEANOGRAPHIC PARAMETERS OFF SOUTHWEST COAST OF INDIA RELEVANT TO PELAGIC FISHERIES. *Indian J. Fish.* 23(1/2):97-104. 1976. SFA 25(2)
[Cent. Mar. Fish. Res. Inst., Cochin-682018, India] The temperature, salinity and oxygen distributions associated with the thermocline of the shelf and adjacent waters off the southwest coast of India are presented seasonwise. The seasonal differences in the location of the thermocline and the magnitude of the vertical temperature gradient within the thermocline are also presented and discussed. The commercially important pelagic fisheries of the waters are also discussed in the light of environmental conditions.

80-001410 Nair, R. V. and R. Soundararajan. ON THE OCCURRENCE OF THE STING RAY *DASYATIS (DASYATIS) MICROPS* (ANNANDALE) ON THE MADRAS COAST AND IN THE GULF OF MANNAR. *Indian J. Fish.* 23(1/2):273-277. 1976. SFA 25(2)
[Mandapam Reg. Cent. C.M.F.R. Inst., Mandapam Camp, India]

80-001411 Noor Hamid, S.; B. Martosudarmo and M. Mardjono. REPORT ON THE STATUS AND OCCURRENCE OF MILKFISH FRY IN INDONESIA. *Bull. Brackishwater Aquacult. Dev. Cent. (Jepara)* 3(1-2):237-246. Jan.-July 1977. SFA 25(2)
[Brackishwater Aquacult. Dev. Cent., Jepara, Indonesia] The intensive culture of milkfish in brackishwater ponds in Indonesia is faced by the problem of the availability of fry for stocking. These milkfish fry are gathered from natural waters along the coast of certain islands in Indonesia. A survey was conducted to known fry collecting centres including search for new fry grounds in South Sumatra. This paper reviews the status of occurrence of milkfish fry in Indonesia. The channels of fry marketing are also discussed.

80-001412 Olney, J. E. and A. Naplin. EGGS OF THE SCALLOPED RIBBONFISH, *ZU CRISTATUS*, (PISCES: TRACHIPTERIDAE) IN THE WESTERN NORTH ATLATNIC. *Copeia* 1980(1):165-166. 1 Feb. 1980. SFA 25(2)
[Va. Inst. Mar. Sci., Gloucester Point 23062]

80-001413 Outten, L. M. FURTHER STREAM STUDIES IN WESTERN NORTH CAROLINA. *J. Elisha Mitchell Sci. Soc.* 94(2):114. 1978. Abstract only. SFA 25(2)

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001414 Paragamian, V. L. INVENTORY AND RELATIVE ABUNDANCE OF CATOSTOMIDS IN THE MAQUOKETA RIVER. *Proc. Iowa Acad. Sci.* 87(1):11-12. Mar. 1980. Abstract only. SFA 25(2)
[Manchester Fish Hatchery, Rt. 2, Manchester, IA 52057]

80-001415 Perry, W. G. and B. J. Carter. SEASONAL OCCURRENCE OF FISHES COLLECTED FROM BEACH SEINING, SOUTHWEST LOUISIANA. *Proc. La. Acad. Sci.* 42:24-38. 1979. SFA 25(2)
[La. Dep. Wildl. Fish., Grand Chenier 70643]

80-001416 Perry, W. G. SEASONAL OCCURRENCE OF FISHES COLLECTED FROM BEACH SEINING, SOUTHWEST LOUISIANA. *Proc. La. Acad. Sci.* 42:83. 1979. Abstract only. SFA 25(2)
[Rt. 1, Box 20B, Grand Chenier, LA 70643]

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80-001418 Phillips, T. D. SEASONAL DISTRIBUTION AND RELATIVE ABUNDANCE OF ICHTHYOPLANKTON IN LOWER HILLSBOROUGH BAY, FLORIDA. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)
[Mote Mar. Lab., 1600 City Island Park, Sarasota, FL 33577] Ichthyoplankton was collected at ten stations in lower Hillsborough Bay from January 1976 through March 1977. Forty one species of larvae representing twenty two families and eggs representing twelve families were identified and counted. Engraulid larvae, primarily those of *Anchoa mitchilli* and *A. hepsetus* constituted 87% of all larvae collected. Eggs of the Engraulids and Sciaenids accounted for 73% and 26% respectively, of all eggs collected. Eggs and larvae were collected during all months of the study. Ichthyoplankton was most abundant between March and October with a noticeable decline in numbers in the middle of the summer and only low numbers were collected through the winter months. Engraulids and sciaenids were dominant during spring and summer and were replaced in the winter by larvae of *Brevoortia* sp., *Gobiesox strumosus*, *Hypsoblennius hentzi* and several species of gobies.

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[Ecol. Sci. Div., NUS Corp., Pittsburg, PA 15220] Abundance of larval sport fishes in the New River, at Glen Lyn, VA, was calculated from catch volume of water sampled through drift nets, and daily river discharge for the period June through August 1976. The estimates of larval sport fish drift included 2,410,000 channel catfish (*Ictalurus punctatus*), 162,000 flathead catfish (*Pylodictis olivaris*), 106,000 rock bass (*Ambloplites rupestris*), 46,900 smallmouth bass (*Micropterus dolomieu*), and 125,000 spotted bass (*M. punctulatus*). The seasonal distribution and occurrence of larvae were comparable to literature reports. Drift sampling may be an effective technique for estimating the absolute abundance of fish at an early developmental stage. These estimates may give fisheries managers the lead time necessary for implementation of effective management strategies in large river systems where it is difficult to sample later life stages quantitatively.

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[Walford, IA 52351] The western mosquito fish (*Gambusia affinis affinis*) was discovered in Lee county, Iowa during seining of various habitats. It occupied the margins of overflow pools of the Mississippi river south of Ft. Madison. It is common in Missouri and Illinois and was expected to be found in southeastern Iowa because of the wide avenue for species dispersal from the south provided by the Mississippi river. This fish was abundant in the area where it was collected, but appeared absent from similar habitat farther south along the river. Additional study must be made to determine whether this population has been introduced or represents a peripheral population.

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[Zool. Dep., Univ. Auckland, Private Bag, Auckland, New Zealand] Census data for fishes observed by scuba divers at selected sites on the east coast of Karikari Peninsula, Northland, are given qualitatively in a checklist. Sixty-four species in 33 families were recorded. Significant new records were those for surgeonfish (*Prionurus maculatus* Ogilby) and rainbow parrotfish (*Suezichthys* sp.). A system for quantification of densities by an underwater transect technique is presented and results are given for three sites; this method could be used by amateur divers to obtain data on the status and structure of coastal reef fish populations in New Zealand. A standardised transect procedure for divers to follow to obtain comparable results is given.

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[N.C. Wildl. Resour. Comm., 512 N. Salisbury St., Raleigh 27611] Data collected from rotenone samples of 3 coves before (1959-65) and after (1977) infestation by Eurasian water-milfoil (*Myriophyllum spicatum*) were compared to document changes in the fish populations. Using the mean of the 3 areas for comparison, both weight and number per hectare increased after

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80-001435 CONTINUED water-milfoil infestation. The average weight per individual decreased from 0.02 kg (1959-65) to 0.008 kg (1977). The species were separated into 7 groups. Six of the groups had higher mean numbers per hectare and all groups had higher mean weights per hectare. Multivariate analyses of variance showed that the population structure had changed for numbers and weights per hectare. Ictalurids and yellow perch (*Perca flavescens*) had the greatest proportionate increases in numbers, whereas largemouth bass (*Micropterus salmoides*) and white perch (*Morone americana*) had the greatest proportionate decreases. Ictalurids and centrarchids, other than largemouth bass, exhibited the greatest proportionate increases in weights per hectare, while largemouth bass and other fish showed the greatest proportionate decreases. Numbers of young-of-the-year and older largemouth bass per hectare were not significantly different between pre- and post-water-milfoil samples.

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[Imperial Coll. Cent. Environ. Technol., 48 Prince's Gardens, London SW7 2PE, England] Marked changes in the relative numbers of roach *Rutilus rutilus* (L.), rudd *Scardinius erythrophthalmus* (L.) and perch *Perca fluviatilis* L., in Slapton Ley, Devon, have been observed over the period 1967-1978. Historically, the lake had been dominated by rudd and perch; significant numbers of roach were not thought to be present until 1967. From then onwards the roach population exhibited a considerable expansion, apparently replacing the rudd, which had virtually disappeared by 1974. In 1975 extensive mortalities of roach were caused by the pseudophyllidean cestode *Ligula intestinalis* L. During 1976 and 1977 larger numbers of rudd, belonging to the 1975 and 1976 year classes, were present, suggesting that the roach mortalities might be giving the rudd a chance to recover. However, very few rudd were present during 1978, possibly because lower incidences of ligulosis during 1976-1978 had allowed the roach to recover from the main outbreak of the disease in 1975, and to replace the rudd for the second time. Evidence from trap catches indicated that the perch population had shown a consistent decline between 1970 and 1977. The major phase of this decrease occurred between 1971 and 1973, when the roach population was increasing the most rapidly. Comparisons were made with changes in fish populations in other localities. The major reason for the changes observed was thought to be a competitive relationship between the plankton feeding younger stages, with roach being the dominant species, although other factors may also have been involved.

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[Fish Res. Div., Minist. Agric. Fish., P.O. Box 19062, Wellington, New Zealand] Fourteen proteins and 12 morphometric characters were examined in specimens of blue maomao and sweep to resolve the question: Are they one or two species? Specimens were fixed for the same alleles at 12 protein loci and shared alleles at 4 polymorphic loci. At a further polymorphic locus they differed in allele frequency and at three loci they did not share alleles. A

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80-001467 CONTINUED genetic distance of 0.209 was found between blue maomao and sweep suggesting that they diverged about 1 million years ago. One meristic character showed a difference between specimens. On the basis of the electrophoretic data and on gill raker counts it is considered that blue maomao and sweep are two separate species. In view of reported differences from Australian specimens the allocation of scientific names at least to sweep remains uncertain.

80-001468 Van Guelpen, L. TAXONOMIC VARIABILITY AND CRITERIA FOR DISTINGUISHING METAMORPHOSING LARVAL AND JUVENILE STAGES OF *LIMANDA FERRUGINEA* AND *HIPPOGLOSSOIDES PLATESSOIDES* (PISCES: PLEURONECTIDAE) FROM THE SCOTIAN SHELF. *Can. J. Zool.* 58(2):202-206. Feb. 1980. In English with English summ. SFA 25(2)

[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada] Metamorphosing larval and juvenile *Limanda ferruginea* and *Hippoglossoides platessoides* from the Scotian Shelf were examined to characterize their taxonomic variability and to establish the reliability of criteria for their identification. The species were found to be separable using several characters. *Limanda ferruginea* had 11 to 12 precaudal and 41 to 44 total vertebrae, 38 to 41 total myomeres, 51 to 67 anal fin rays, and usually metamorphosed at less than 16 mm standard length (SL). *Hippoglossoides platessoides* had 13 to 14 precaudal and 45 to 48 total vertebrae, 44 to 47 total myomeres, 62 to 76 anal fin rays, and usually metamorphosed at greater than 25 mm SL. Anal fin ray counts and size at metamorphosis were of limited diagnostic value only. In addition, stage IV *L. ferruginea* usually had dark gut pigment and a visible modified first anal pterygiophore (anal spine), whereas *H. platessoides* had light gut pigment and no visible anal spine. Dark gut pigment also was diagnostic for juvenile *L. ferruginea* still prossessing this character.

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[Dep. Zool., Brandon Univ., Brandon, MB R7A 6A9, Canada]

80-001474 Ingram, G. A. SUBSTANCES INVOLVED IN THE NATURAL RESISTANCE OF FISH TO INFECTION--A REVIEW. *J. Fish Biol.* 16(1):23-60. Jan. 1980. SFA 25(2)
[Dep. Biol., Gardner St. Annexe, Univ. Salford, Salford M6 6WZ, Lancashire, England] Natural 'antibodies' are substances found in the blood of animals that have not been immunised against infective agents. However, exposure to these agents or to cross-reacting antigens may well have taken place. Fish contain naturally-occurring, relatively non-specific, lectin-like proteins or glycoproteins, which are distinct from immunoglobulins, and which react with a wide variety of antigens and may confer some degree of immunity against natural infection. In most cases the cause of the antigenic stimulus is not obvious although the formation of these 'antibodies' may have been brought about by exposure to various micro-organisms. Many of these antibody-like molecules behave in a similar manner to immune antibodies or immunoglobulins and cross-react with specific carbohydrate moieties on the cell walls of bacteria, erythrocytes and certain other cellular antigens, due to the presence of similar antigenic determinants. It is difficult to ascribe an appropriate definition to the term 'natural antibody'. In fish, these 'antibodies' have been so designated on the basis of functional rather than structural criteria. Such naturally-occurring, low grade, antibody-like 'immune' substances include 'acute phase' proteins, lysozyme and chitinase, interferon, agglutinins, lysins, complement and properdin, precipitins, and non-immunoglobulin, lectin-like molecules. In addition to the above non-immunoglobulin materials, natural immunoglobulins identifiable as IgM have also been reported in fish. Furthermore, mucus contains many biochemical agents capable of reaction against infective organisms and thus providing the host with an immediate or a first line of defence mechanism. This review compiles some of the relevant information in the literature concerned with natural 'immune' sbustances, present in the serum and mucus of fish, involved in protection against pathogens. Wherever possible the basic physicochemical properties of these substances are indicated and their potential immunobiological functions are discussed.

80-001475 Katae, H.; K. Kouno; Y. Takase; H. Miyazaki; M. Hashimoto and M. Shimizu. THE EVALUATION OF PIROMIDIC ACID AS AN ANTIBIOTIC IN FISH: *AN IN VITRO* AND *IN VIVO* STUDY. *J. Fish Dis.* 2(4):321-335. July 1979. SFA 25(2)

80-001476 McCain, B. B.; W. D. Gronlund; M. S. Myers and S. R. Wellings. TUMOURS AND MICROBIAL DISEASES OF MARINE FISHES IN ALASKAN WATERS. *J. Fish Dis.* 2(2):111-130. Mar. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001477 Olson, L. J. HOST-PARASITE ASSOCIATIONS OF THE GRUNIONS, *LEURESTHES SARDINA* AND *LEURESTHES TENUIS*, FROM THE GULF OF CALIFORNIA AND CALIFORNIA. *Ph.D. dissertation, Univ. Ariz.* 111p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4164. Mar. 1980. SFA 25(2)

PARASITES AND DISEASES-GENERAL

80-001478 Rijkers, G. T.; A. G. Teunissen; R. Van Oosterom; and W. B. Van Muiswinkel. THE IMMUNE SYSTEM OF CYPRINID FISH. THE IMMUNOSUPPRESSIVE EFFECT OF THE ANTIBIOTIC OXYTETRACYCLINE IN CARP (*CYPRINUS CARPIO* L.). *Aquaculture* 19(2):177-189. Feb. 1980. SFA 25(2)
[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Zodiac, Marijkeweg 40, 6709 PG Wageningen, The Netherlands]

80-001479 Spannhof, L., D. Nasev and H.-L. Kreutzmann. EARLY RECOGNITION OF METABOLIC DISTURBANCES IN TROUT (*SALMO GAIRDNERI* RICH.) STOCKS. *Aquaculture* 18(4):317-323. Dec. 1979. SFA 25(2)
[Dep. Biol. Wilhelm Pieck Univ. Rostock, Universitätsplatz 2, 25 Rostock, West Germany] A method is proposed for detecting metabolic disturbances or diseases in trout stocks before typical symptoms appear. The method involves determination of erythrocyte numbers, hemoglobin contents, and hematocrit readings for about 10 animals. The measured parameters are tested for independence. The results permit the stocks tested to be classified as "normal" or "not normal".

80-001480 Watson, R. A. and T. A. Dick. METAZOAN PARASITES OF WHITEFISH *COREGONUS CLUPEAFORMIS* (MITCHILL) AND CISCO *C. ARTEDII* LESUEUR FROM SOUTHERN INDIAN LAKE, MANITOBA. *J. Fish Biol.* 15(5):579-587. Nov. 1979. SFA 25(2)
[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada]

BACTERIAL DISEASES

80-001491 Håstein, T.; S. J. Saltveit and R. J. Roberts. MASS MORTALITY AMONG MINNOWS *PHOXINUS PHOXINUS* (L.) IN LAKE TVEITEVATN, NORWAY, DUE TO AN ABERRANT STRAIN OF *AEROMONAS SALMONICIDA*. *J. Fish Dis.* 1(3):241-249. July 1978. SFA 25(2)
[Nat. Vet. Inst., P.O. Box 8156, Oslo, Norway]

80-001492 Anderson, D. P.; B. S. Robertson and O. W. Dixon. CELLULAR IMMUNE RESPONSE IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON TO *YERSINIA RUCKERI* O-ANTIGEN MONITORED BY THE PASSIVE HAEMOLYTIC PLAQUE ASSAY TEST. *J. Fish. Dis.* 2(3):169-178. May 1979. SFA 25(2)
[U.S. FWS, Rt. 3, Box 50, Kearneysville, WV 25430] The specificity and kinetics of the immune response of rainbow trout (*Salmo gairdneri*) to single injections of an O-antigen extracted from the bacterial pathogen *Yersinia ruckeri*, which causes enteric redmouth in fish, were investigated by the passive haemolytic plaque assay and serum antibody quantitation. Doses ranging from 5 ng to 500 mg in 10-fold increments were injected intraperitoneally into groups of trout held at 17±1.5°C. The occurrence of plaque forming cells (PFC) and humoral antibody was followed for 35 days after injection. Trout gave an immune response to doses of 500 ng and above. Seven days after injection no humoral antibody was detected, but PFC were found in the spleen. The maximum PFC numbers occurred 11 days after injection. On day 21, few PFC were found, whereas serum antibody titres were highest. The antibody from immunized trout showed little or no cross-reactions with sheep red blood cells passively labelled with antigens from other fish pathogens.

BACTERIAL DISEASES

80-001483 Bach, R.; P. K. Chen and G. B. Chapman. CHANGES IN THE SPLEEN OF THE CHANNEL CATFISH *ICTALURUS PUNCTATUS* RAFINESQUE INDUCED BY INFECTION WITH *AEROMONAS HYDROPHILA*. *J. Fish Dis.* 1(3):205-217. July 1978. SFA 25(2)
[P. K. Chen: Dep. Biol., Georgetown Univ., Washington, DC 20057]

80-001484 Barham, W. T.; G. L. Smit and H. J. Schoonbee. THE EFFECT OF BACTERIAL INFECTION ON ERYTHROCYTE FRAGILITY AND SEDIMENTATION RATE OF RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Biol.* 16(2):177-180. Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Zululand, Private Bag, Kwa-Dlangezwa 3886, South Africa] Osmotic fragilities and erythrocyte sedimentation rates (ESR) were measured in healthy, diseased, treated and recovered trout, *Salmo gairdneri*. Bacterial infection with *Aeromonas* and *Streptococcus* resulted in more fragile erythrocytes and raised ESR values. Treatment with antibacterial agents improved the values of both parameters. Possible reasons for such changes are discussed. Caution in the use of apparently healthy fish for the unqualified interpretation of haematological results is expressed.

80-001485 Bejerano, Y.; S. Sarig; M. T. Horne and R. J. Roberts. MASS MORTALITIES IN SILVER CARP *HYPOPHTHALMICHTHYS MOLITRIX* (VALENCIENNES) ASSOCIATED WITH BACTERIAL INFECTION FOLLOWING HANDLING. *J. Fish Dis.* 2(1):49-56. Jan. 1979. SFA 25(2)
[R. J. Roberts: Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] Mass mortalities in silver carp were related to infection of handling lesions with *Proteus rettgeri*, a gram negative bacterium normally found in the gut of poultry. Poultry faeces are used extensively to fertilize carp ponds and experimental infections showed that the condition could be reproduced by scarification and exposure to the micro-organism or by its inoculation.

80-001486 Bullock, G. L.; B. R. Griffin and H. M. Stuckey. DETECTION OF *CORYNEBACTERIUM SALMONINUS* BY DIRECT FLUORESCENT ANTIBODY TEST. *Can. J. Fish. Aquatic Sci.* 37(4):719-721. Apr. 1980. SFA 25(2)
[U.S. FWS, Natl. Fish Health Res. Lab., Rt. 3, Box 50, Kearneysville, WV 25430]

80-001487 Bullock, G. L.; H. M. Stuckey and E. B. Shotts, Jr. ENTERIC REDMOUTH BACTERIUM: COMPARISON OF ISOLATES FROM DIFFERENT GEOGRAPHIC AREAS. *J. Fish Dis.* 1(4):351-356. Oct. 1978. SFA 25(2)
[U.S. FWS, Natl. Fish Health Res. Lab., Kearneysville, WV 25430] Characteristics of 18 strains of *Yersinia ruckeri* the causative agent of enteric redmouth disease, from a variety of hosts and a wide geographic range were compared. Except for variations in colonial morphology and in citrate, sorbitol, and trehalose reactions, the strains were morphologically and biochemically homogeneous. Sixteen strains reacted with antiserum against the first serotype reported, and one strain reacted with antiserum against a more recently reported serotype. One strain represented a third serotype. Evidence presented indicated that extension of the geographic range may not be entirely a result of the transport of carrier fish.

80-001488 Egidius, E. and K. Andersen. THE USE OF FURANACE AGAINST VIBRIOSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN SALT WATER. *J. Fish Dis.* 2(1):79-80. Jan. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., 5011 Bergen-Nordnes, Norway]

BACTERIAL DISEASES

80-001489 Egidius, E. C. and K. Andersen. BATH-IMMUNIZATION--A PRACTICAL AND NON-STRESSING METHOD OF VACCINATING SEA FARMED RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON AGAINST VIBRIOSIS. *J. Fish Dis.* 2(5):405-410. Sept. 1979. SFA 25(2)

[Inst. Mar. Res., Boks 1870-72, 5011 Bergen-Nordnes, Norway] A non-stressing easily applicable vaccination method against vibriosis in rainbow trout is described. The vaccine consisted of trypsin digested *Vibrio anguillarum* cells and was administered through a 2 h bath treatment, giving adequate protection in challenge experiments with the same *V. anguillarum* strain.

80-001490 Ferguson, H. W. and D. H. McCarthy. HISTOPATHOLOGY OF FURUNCULOSIS IN BROWN TROUT *SALMO TRUTTA* L. *J. Fish. Dis.* 1(2):165-174. Apr. 1978. SFA 25(2)

[Vet. Res. Lab., The Farm, Stormont, Belfast, Northern Ireland]

80-001491 Flagg, R. M. and L. W. Hinck. INFLUENCE OF AMMONIA ON AEROMONAD SUSCEPTIBILITY IN CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:415-419. 1978[1979]. SFA 25(2)

[Biol. Sci., Ark. State Univ., State University 72467] The effects of un-ionized ammonia on channel catfish (*Ictalurus punctatus*) resistance to aeromonad invasion were tested. Host susceptibility to *Aeromonas hydrophila* was related to ammonia concentration and time of exposure. Numbers of bacteria recovered from host livers increased as concentrations of un-ionized ammonia were increased in the range of 0.02-0.04 mg/l NH_3. The effect of longer exposure time at these concentrations also proved to be significant ($P<0.01$) in lowering host resistance.

80-001492 Giavenni, R. ALCUNI ASPETTI ZOONOSICI DELLE MICOBATTERIOSI DI ORIGINE ITTICA. [HUMAN SKIN LESIONS BY FISH MYCOBACTERIA.] *Riv. It. Piscic. Ittiop.* 14(4):123-126. Oct.-Nov.-Dec. 1979. In Italian with English summ. SFA 25(2)

[Med. Vet., S.I.R.A.P. S.p.A., 30100 Pellestrina, Venezia, Italy]

80-001493 Harbell, S. C.; H. O. Hodgins and M. H. Schiewe. STUDIES ON THE PATHOGENESIS OF VIBIOSIS IN COHO SALMON *ONCORHYNCHUS KISUTCH* (WALBAUM). *J. Fish Dis.* 2(5):391-404. Sept. 1979. SFA 25(2)

[M. H. Schiewe: NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Juvenile coho salmon *Oncorhynchus kisutch* (Walbaum), cultured in fresh water, were experimentally infected with highly virulent *Vibrio anguillarum*, and various haematological and biochemical parameters were compared between moribund and non-infected control fish. In addition, endotoxin, culture supernatant, and cell lysate preparations of *V. anguillarum* were tested separately and in combination to assess their roles in mediating pathological effects. The haematocrit, haemoglobin, numbers of red and white blood cells and plasma, total protein, albumin, β_2 globulin, chloride, sodium, osmolality and alkaline phosphatase levels were all decreased in infected fish compared to controls. Erythrocyte fragility and plasma glucose, potassium, lactate dehydrogenase (LDH), and glutamic oxaloacetic transaminase (GOT) levels were increased in infected fish. No mortality nor significant changes in haematocrit or plasma protein occurred in fish infected intraperitoneally with 35 mg/kg (1 mouse LD_{50}) of *V. anguillarum* endotoxin, with culture supernatant fluid, cell lysate, or with combinations of three preparations. There was, however, a decrease in plasma protein concentration in coho injected with 355 mg/kg (10 mouse LD_{50}s) of endotoxin, but no mortality nor significant change in haematocrit.

BACTERIAL DISEASES

80-001494 Huizinga, H. W.; G. W. Esch and T. C. Hazen. HISTOPATHOLOGY OF RED-SORE DISEASE (*AEROMONAS HYDROPHILA*) IN NATURALLY AND EXPERIMENTALLY INFECTED LARGEMOUTH BASS *MICROPTERUS SALMOIDES* (LACÉPÈDE). *J. Fish. Dis.* 2(4):263-277. July 1979. SFA 25(2)

[G. W. Esch: Dep. Biol., Wake Forest Univ., Winston-Salem, NC 27109] The histopathology of red-sore disease, caused by the gram-negative bacterium, *Aeromonas hydrophila*, is described for largemouth bass, *Micropterus salmoides*. Externally, lesions range from those affecting a few scales (pin-point), to those associated with extensive chronic ulcerations; there is focal haemorrhage, oedema and dermal necrosis which exposes underlying muscles producing infiltration of mononuclear and granulocytic inflammatory cells. Internally, the liver and kidneys are foci for toxic products produced by *A. hydrophila* with, in the most severe cases, complete destruction of the structural integrity of both organs. Pathological changes were not serious in either the spleen or heart, even in cases with massive damage in the liver and kidney. Internal and external lesions were similar in both natural and experimentally induced infections. The pathobiology of red-sore disease in bass is postulated to be linked to elevated water temperature stimulating increased metabolism, decreased body condition and stress, leading to the increased production of corticosteroids and the concomitant rise in susceptibility to infection.

80-001495 Inebi, W. and M. T. Horne. A COMPLEMENT-FIXATION METHOD FOR THE DETECTION OF *VIBRIO*-SPECIFIC ANTIBODIES IN RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 2(2):159-160. Mar. 1979. SFA 25(2)

[Dep. Biol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001496 Ingram, G. A. and J. B. Alexander. THE IMMUNE RESPONSE OF THE BROWN TROUT *SALMO TRUTTA* TO LIPOPOLYSACCHARIDE. *J. Fish Biol.* 16(2):181-197. Feb. 1980. SFA 25(2)

[Dep. Biol., Gardner St. Annexe, Univ. Salford, Salford M6 6WZ, England] Brown trout produced high molecular weight, thermostable, dithiothreitol sensitive, non-precipitating, complement-fixing antibodies and agglutinins to lipopolysaccharides after intramuscular injection with adjuvant. Antibodies were first detected on Day 14 and reached maximum titres after 56 to 63 days when a single injection was given. When either a second or third injection was administered maximum titres occurred 34 to 40 days after the injection. After each injection the titres increased significantly, and the protein concentration of the sera was significantly decreased. In cellulose acetate electrophoresis experiments those bands which migrated in the β- to γ-globulin regions were increased. Antibody-secreting and antigen-binding cells were detected on Days 8 and 4 respectively and maxima were reached between Day 16 and Day 18. The number of cells per 10^6 lymphoid cells was higher in the spleen than in the kidney.

80-001497 Katae, H.; K. Kouno; Y. Sekine; M. Hashimoto and M. Shimizu. DISTRIBUTION, EXCRETION AND BIOTRANSFORMATION OF ^{14}C-PIROMIDIC ACID IN GOLDFISH *CARASSIUS AURATUS* (L.). *J. Fish Dis.* 2(6):529-542. Nov. 1979. SFA 25(2)

[M. Shimizu: Res. Lab., Dainippon Pharmaceutical Co., Ltd., 33-94 Enoki-cho, Suita, Osaka, 564, Japan]

80-001498 Kimura, H. and R. Kusuda. STUDIES ON THE PATHOGENESIS OF STREPTOCOCCAL INFECTION IN CULTURED YELLOWTAILS *SERIOLA* SPP.: EFFECT OF THE CELL FREE CULTURE ON EXPERIMENTAL STREPTOCOCCAL INFECTION. *J. Fish Dis.* 2(6):501-510. Nov. 1979. SFA 25(2)

[R. Kusuda: Fish Dis. Lab., Dep. Cult. Fish, Fac. Agric. Kochi Univ., Nankoku, Kochi Pref., Japan]

BACTERIAL DISEASES

80-001499 Laidler, L. A. DETECTION AND IDENTIFICATION OF THE BACTERIAL KIDNEY DISEASE (BKD) ORGANISM BY THE INDIRECT FLUORESCENT ANTIBODY TECHNIQUE. *J. Fish Dis.* 3(1):67-69. Jan. 1980. SFA 25(2)
[M.A.F.F. Vet. Invest. Cent., Calthwaite, Penrith, Cumbria, England]

80-001500 Llewellyn, L. C. A BACTERIUM WITH SIMILARITIES TO THE REDMOUTH BACTERIUM AND *SERRATIA LIQUEFACIENS* (GRIMES AND HENNERTY) CAUSING MORTALITIES IN HATCHERY REARED SALMONIDS IN AUSTRALIA. *J. Fish Dis.* 3(1):29-39. Jan. 1980. SFA 25(2)
[N.S.W. State Fish., Sydney, New South Wales, Australia] Blood spots in the eye and haemorrhages in the musculature of the caudal peduncle were the main indication of disease in Australian hatchery reared brook trout *Salvelinus fontinalis* (Mitchill) and Atlantic salmon *Salmo salar* L. Mortalities of 0.1-0.5% per day occurred for 3-4 weeks in fish stocked in circular ponds in the months of February and March when temperatures were falling from 23-11°C. The bacterium belonging to the Family Enterobacteriacae had similarities with *Yersinia ruckeri* (the RM bacterium) and *Serratia liquefaciens*. As a temporary designation SBS was used. It is recommended that its taxonomic position remain *sub judice* for the present. Inoculation experiments on brook trout and landlocked Atlantic salmon indicated that signs appeared 2-7 days after inoculation and that rainbow trout *Salmo gairdneri* Richardson were resistant to the disease.

80-001501 Lounatmaa, K. and J. Janatuinen. ELECTRON MICROSCOPY OF AN ULCERATIVE DERMAL NECROSIS (UDN)-LIKE SALMON DISEASE IN FINLAND. *J. Fish Dis.* 1(4):369-375. Oct. 1978. SFA 25(2)
[Dep. Electron Microsc., Univ. Helsinki, Malminkatu 20, SF-00100 Helsinki 10, Finland]

80-001502 Michel, C. A STANDARDIZED MODEL OF EXPERIMENTAL FURUNCULOSIS IN RAINBOW TROUT (*SALMO GAIRDNERI*). *Can. J. Fish. Aquatic Sci.* 37(4):749-750. Apr. 1980. SFA 25(2)
[Inst. Natl. Rech. Agron., Lab. Ichtyopathol., route de Thiverval, 78850 Thiverval-Grignon, France]

80-001503 Nishibuchi, M.; K. Muroga; R. J. Seidler and J. L. Fryer. PATHOGENIC *VIBRIO* ISOLATED FROM CULTURED EELS--IV. DEOXYRIBONUCLEIC ACID STUDIES. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1469-1473. Dec. 1979. SFA 25(2)
[Fac. Appl. Biol. Sci., Hiroshima Univ., 2-17 Midori-Machi, Fukuyama 720, Japan]

80-001504 Reynolds, W. W.; J. B. Covert and M. E. Casterlin. FEBRILE RESPONSES OF GOLDFISH *CARASSIUS AURATUS* (L.) TO *AEROMONAS HYDROPHILA* AND TO *ESCHERICHIA COLI* ENDOTOXIN. *J. Fish Dis.* 1(3):271-273. SFA 25(2)
[Dep. Biol., Pa. State Univ., Wilkes-Barre 18708]

80-001505 Roberts, R. J. and M. T. Horne. BACTERIAL MENINGITIS IN FARMED RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON AFFECTED WITH CHRONIC PANCREATIC NECROSIS. *J. Fish Dis.* 1(2):157-164. Apr. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Scotland] Chronic mortalities associated with meningeal and pancreatic lesions are described, from two trout farms in Scotland. Histopathological and microbiological studies

BACTERIAL DISEASES

80-001505 CONTINUED suggested that bacterial infection with strains of *Pseudomonas fluorescens* of low pathogenicity was developing in fish already affected by the lesions of chronic infectious pancreatic necrosis virus infection (IPN). Antibiotic therapy reduced losses temporarily; eradiation of the virus resulted in complete elimination of the condition.

FUNGAL DISEASES

80-001506 Agius, C. INFECTION BY AN *ICHTHYOPHONUS*-LIKE FUNGUS IN THE DEEP-SEA SCABBARD FISH *APHANOPUS CARBO* (LOWE) (TRICHIURIDAE) IN THE NORTH EAST ATLANTIC. *J. Fish Dis.* 1(2):191-193. Apr. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001507 Blazer, V. S. and R. E. Wolke. AN *EXOPHIALA*-LIKE FUNGUS AS THE CAUSE OF A SYSTEMIC MYCOSIS OF MARINE FISH. *J. Fish Dis.* 2(2):145-152. Mar. 1979. SFA 25(2)
[R. E. Wolke: Mar. Pathol. Lab., Dep. Anim. Pathol., Univ. R.I., Kingston 02881]

80-001508 Emerson, M.; B. L. Nicholson and R. Bayer. EFFECTS OF *ACHOLEPLASMA LAIDLAWII* AND AN UNIDENTIFIED MYCOPLASMA ON SELECTED FISH CELL CULTURES AND THE REPLICATION OF FISH VIRUSES. *J. Fish. Dis.* 2(3):227-238. May 1979. SFA 25(2)
[B. L. Nicholson: Dep. Microbiol., Univ. Me., Orono 04473] An unidentified mycoplasma was isolated from cultures of Atlantic salmon (AS) cells and implicated as the cause of cytopathic effects (CPE). The agent did not visibly affect RTG-2 cells. Experimental infection of RTG-2 cells with *Acholeplasma laidlawii* resulted in increased cellular granularity and destruction. Scanning electron microscopic (SEM) examination of infected RTG-2 and AS cultures revealed typical mycoplasmas distributed on cell surfaces and a marked effect on the cell surface topography, characterized by a loss of microvilli and cellular processes. SEM also revealed mycoplasmal contamination that was not detected by culturing. Comparisons of contaminated and uncontaminated RTG-2 cells showed enhanced (2-100 fold) replication of infectious pancreatic necrosis virus (IPNV) and infectious haematopoietic necrosis virus (IHNV) in the presence of *A. laidlawii*.

80-001509 Richards, R. H.; A. Holliman and S. Helgason. *EXOPHIALA SALMONIS* INFECTION IN ATLANTIC SALMON *SALMO SALAR* L. *J. Fish Dis.* 1(4):357-368. Oct. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001510 Richards, R. H. and A. D. Pickering. CHANGES IN SERUM PARAMETERS OF *SAPROLEGNIA*-INFECTED BROWN TROUT, *SALMO TRUTTA* L. *J. Fish Dis.* 2(3):197-206. May 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling, FK9 4LA, Scotland] Fungal infection of both wild and hatchery-reared sexually mature brown trout, *Salmo trutta* L., was caused by *Saprolegnia diclina* Humphrey Type 1. The major ions in the serum of infected fish were all significantly reduced in concentration and it is suggested that the primary cause of death was osmoregulatory breakdown resulting in a lethal haemodilution. Severe

FUNGAL DISEASES

80-001510 CONTINUED hypoproteinaemia and a significant reduction in the albumin/globulin ratio were reflected in the electrophoretogram of the serum proteins from infected fish.

PROTOZOAN DISEASES

80-001511 Molnár, K. RENAL SPHAEROSPOROSIS IN THE COMMON CARP *CYPRINUS CARPIO* L. *J. Fish Dis.* 3(1):11-19. Jan. 1980. SFA 25(2)
[Vet. Med. Res. Inst., Hungarian Acad. Sci., Budapest, Hungary] *Sphaerospora angulata* fujita, 1912, has been identified as a frequent renal parasite of cultured carp populations in Hungary. Its prevalence ranged from 10 to 50% in the pond farms surveyed. The youngest carp infected were 2 1/2-3 months old. Infections were not common in one-summer fish and tended to become less frequent with increasing age of the host. The developing stages of *S. angulata* are found in the contorted tubules of the trunk-kidney but never invade the parenchymal tissue of the trunk or head-kidneys. The pansporoblasts developing in the wide proximal segment of the renal tubules, and the spores arising from the pansporoblasts are typically coelozoic parasites, for they apparently do not damage the tubular lining epithelium, nor its brush border. The main adverse effect of *S. angulata* is probably depression of resistance owing partly to deprivation of the host of nutrients secreted by the glomeruli and partly to mechanical obstruction of the distal tubular segments.

80-001512 Andrews, C. THE OCCURRENCE OF *HENNEGUYA PSOROSPERMICA* THÉLOHAN, 1895 (MYXOSPORIDA) ON PERCH, *PERCA FLUVIATILIS* L., FROM LLYN TEGID, WALES. *J. Fish Dis.* 2(1):27-33. Jan. 1979. SFA 25(2)
[Yorkshire Water Authority, Olympia House, Gelderd Rd., Leeds LS12 6DD, England]

80-001513 Becker, C. D. and R. M. Overstreet. HAEMATOZOA OF MARINE FISHES FROM THE NORTHERN GULF OF MEXICO. *J. Fish Dis.* 2(6):469-479. Nov. 1979. SFA 25(2)
[Battelle Mem. Inst., Pac. Northwest Lab., Richland, WA 99352]

80-001514 Becker, C. D. HAEMATOZOA FROM RESIDENT AND ANADROMOUS FISHES OF THE CENTRAL COLUMBIA RIVER: A SURVEY. *Can. J. Zool.* 58(3):356-362. Mar. 1980. In English with French summ. SFA 25(2)
[Ecol. Sci. Dep., Pac. Northwest Lab., Richland, WA 99352]

80-001515 Berrebi, P. ETUDE ULTRASTRUCTURAL DE *GLUGEA ATHERINAE* N. SP., MICROSPORIDIE PARASITE DE L'ATHÉRINE *ATHERINA BOYERI* RISSO 1810 (POISSON TÉLÉOSTÉEN) DANS LES LAGUNES DU LANGUEDOC ET DE PROVENCE. [ULTRASTRUCTURAL STUDIES OF *GLUGEA ATHERINAE* N. SP., MICROSPORIDIA PARASITE OF *ATHERINA BOYERI* RISSO 1810 (PISCES, TELEOSTAEN) IN THE LANGUEDOC AND PROVENCE LAGOONS.] *Z. Parasitenkd.* 60(2):105-122. 1979. In French with English summ. SFA 25(2)
[Lab. Ichthyol., Univ. Sci. Tech. Lang., Place Eugene Bataillon, 34060 Montpellier Cedex, France]

PROTOZOAN DISEASES

80-001516 Cheung, P. J.; R. F. Nigrelli and G. D. Ruggieri. STUDIES ON CRYPTOCARYONIASIS IN MARINE FISH: EFFECT OF TEMPERATURE AND SALINITY ON THE REPRODUCTIVE CYCLE OF *CRYPTOCARYON IRRITANS* BROWN, 1951. *J. Fish Dis.* 2(2):93-97. Mar. 1979. SFA 25(2)
[Osborn Lab. Mar. Sci., N.Y. Aquarium, N.Y. Zool. Soc., Brooklyn, NY 11224] Trophonts of *Cryptocaryon irritans* Brown from infected three-spot damselfish, *Dascyllus trimaculatus* Ruppell, were kept at temperatures ranging from 7 to 37°C to observe encystment and development of the tomites. At 30, 25 and 20°C, the percentage of trophonts that had encysted in 16 h were 70, 77 and 64% respectively; at 37°, 44% encysted and at 7°C only 10% had encysted. The optimum temperature for encystment was 30°C; 50% excysted in 5 days and 100% in 7 days. At 25°C, 60% of the tomites started to excyst on the eighth day, and 70% on the ninth day. At 20°C, 10% started to excyst on the ninth day, reaching 40% on the tenth day. No excystment occurred at 37 and 7°C. Newly encysted tomonts were placed in various dilutions of sea water (31°/oo) and kept at temperatures ranging from 7 to 37°C. Low salinities, i.e. 16°/oo and lower caused tomonts to rupture. At 37, 20 and 7°C, 35% of the tomonts started to rupture immediately in 50% sea water, while at 30 and 25°C, 30% of the tomonts ruptured in 25% seawater. However, none of the cysts developed normally at these dilutions. The percentage rupturing increased with decreasing salinity.

80-001517 Current, W. L.; J. Janovy, Jr. and S.A. Knight. *MYXOSOMA FUNDULI* KUDO (MYXOSPORIDA) IN *FUNDULUS KANSAE*: ULTRASTRUCTURE OF THE PLASMODIUM WALL AND OF SPOROGENESIS. *J. Protozool.* 26(4):574-583. Nov. 1979. SFA 25(2)
[Dep. Zool.-Entomol., Auburn Univ., Auburn, AL 36830]

80-001518 de Kinkelin, P. OCCURRENCE OF A MICROSPORIDIAN INFECTION IN ZEBRA DANIO *BRACHYDANIO RERIO* (HAMILTON-BUCHANAN). *J. Fish Dis.* 3(1):71-73. Jan. 1980. SFA 25(2)
[Lab. Ichtyopathol., Inst. Natl. Rech. Agron. 78850 Thiverval-Grignon, France]

80-001519 Dyková, I. and J. Lom. HISTOPATHOLOGICAL CHANGES IN *TRYPANOSOMA DANILEWSKYI* LAVERAN & MESNIL, 1904 AND *TRYPANOPLASMA BORELLI* LAVERAN & MESNIL, 1902 INFECTIONS OF GOLDFISH, *CARASSIUS AURATUS* (L.). *J. Fish Dis.* 2(5):381-390. Sept. 1979. SFA 25(2)
[Inst. Parasitol., Czech. Acad. Sci., Flemingovo nám-2, 166 32 Prague 6, Czechoslovakia]

80-001520 Ellis, A. E. and R. Wootten. COSTIASIS OF ATLANTIC SALMON, *SALMO SALAR* L. SMOLTS IN SEAWATER. *J. Fish Dis.* 1(4):389-393. Oct. 1978. SFA 25(2)
[Mar. Lab., Victoria Rd., Aberdeen AB9 8DB, Scotland]

80-001521 Ferguson, H. W. SCANNING AND TRANSMISSION ELECTRON MICROSCOPICAL OBSERVATIONS ON *HEXAMITA SALMONIS* (MOORE, 1922) RELATED TO MORTALITIES IN RAINBOW TROUT FRY *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 2(1):57-67. Jan. 1979. SFA 25(2)
[Vet. Res. Lab., Stormont, Belfast BT4 3SD, Northern Ireland] Examination of the digestive tract of rainbow trout fry infected with *Hexamita salmonis* revealed no pathological changes in the epithelial cells of the pyloric caeca or upper intestine even where the parasites were closely apposed to the brush border of these cells. No invasion of the epithelium by

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80-001521 CONTINUED the parasites was observed, although examples of shrinkage necrosis (apoptotic bodies) of epithelial cells were often found. The ultrastructure of the parasites resembled that of the closely related *Giardia lamblia*. Despite the lack of pathological changes to the intestinal epithelium, treatment of the fish to remove the parasites greatly reduced mortalities.

80-001522 Hoffman, G. L. and R. Walker. A NEW MYXOSPORIDAN, *DICAUDA ATHERINOIDI* N.G., N. SP., OF THE MINNOW, *NOTROPIS ATHERINOIDES* RAFINESQUE. *J. Fish Dis.* 1(4):343-349. Oct. 1978. SFA 25(2)
[U.S. FWS, P.O. Box 860, Stuttgart, AR 72160]

80-001523 Hoffman, G. L.; S. L. Kazubski; A. J. Mitchell and C. E. Smith. *CHILODONELLA HEXASTICHA* (KIERNIK, 1909) (PROTOZOA, CILIATA) FROM NORTH AMERICAN WARMWATER FISH. *J. Fish Dis.* 2(2):153-157. Mar. 1979. SFA 25(2)
[U.S. FWS, P.O. Box 860, Stuttgart, AR 72160]

80-001524 Kirmse, P. D. *HAEMOGREGARINA SACHAI* N.SP. FROM CULTURED TURBOT *SCOPHTHALMUS MAXIMUS* (L.) IN SCOTLAND. *J. Fish Dis.* 1(4):337-342. Oct. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001525 Molnar, K. and M. Reinhardt. INTESTINAL LESIONS IN GRASSCARP *CTENOPHARYNGODON IDELLA* (VALENCIENNES) INFECTED WITH *BALANTIDIUM CTENOPHARYNGODONIS* CHEN. *J. Fish. Dis.* 1(2):151-156. Apr. 1978. SFA 25(2)
[Vet. Med. Res. Inst., Hungarian Acad. Sci., Budapest, Hungary] The protozoan *Balantidium ctenopharyngodonis* is a common intestinal commensal of two-summer and older grasscarp, but it may occasionally become pathogenic under the influence of certain predisposing factors. Outbreaks of enteritis complicated by excess multiplication of balantidia occurred among the two-summer and three-summer grasscarp stock in two pond farms during the autumn and winter. Fishes in the terminal stage of disease showed hyperaemia and inflammation of the mucosa over the entire gut. In the posterior 10-12 cm of the gut a dense creamy exudate coated the mucosa. Large numbers of balantidia were found in the exudate and between the mucosal folds there were excoriations, the size of a pin-head, obviously caused by the parasites. Histological examination revealed a loss of superficial epithelium and ulcerations in the grooves between folds.

80-001526 Rau, M. E. and D. M. Gordon. THE FREQUENCY DISTRIBUTION OF TETRACOTYLES OF *APATEMON GRACILIS PELLUCIDUS* (YAMAGUTI, 1933) IN STICKLEBACK *CULAEA INCONSTANS* (KIRTLAND) POPULATIONS OF HOMOGENEOUS AGE AND SIZE STRUCTURE. *J. Fish Dis.* 1(3):259-263. July 1978. SFA 25(2)
[Inst. Parasitol., McGill Univ., Macdonald Coll. P.O., PQ H0A 1C0, Canada] The frequency distribution of tetracotyles of *Apatemon gracilis pellucidus* in natural populations of brook sticklebacks *Culaea inconstans* homogeneous for age and size were fitted to negative binomial curves. Vales of k were unusually high while the degree of overdispersion was correspondingly low. It is suggested that these properties of the distributions are a function of the homogeneity of the host population.

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80-001527 Robertson, D. A. HOST-PARASITE INTERACTIONS BETWEEN *ICHTYOBODO NECATOR* (HENNEGUY, 1883) AND FARMED SALMONIDS. *J. Fish Dis.* 2(6):481-491. Nov. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] The prevalence and intensity of *Ichtyobodo necator* infestations on farmed salmonids was investigated over a 7-month period. The infestations were found to be markedly age dependent. *Ichtyobodo* infestations peaked at 4 weeks after commencement of first feeding and mortalities peaked at 4.6% per week at 8 weeks in the 0+ fish. Both infestations and mortalities showed a marked decline to zero shortly after these periods with no chemotherapy. No *Ichtyobodo* were seen on the 1+ fish until late in the study after a drop in temperature to below 10°C, when they reappeared in the 0+ fish also. *Ichtyobodo* were found at temperatures between 3.5°C and 16°C and in the 0+ fish appeared irrespective of the condition of the fish. It is suggested that some form of host defence mechanism is operating which limits *Ichtyobodo* infestations in farmed salmonids.

80-001528 Wyatt, E. J. STUDIES ON THE EPIZOOTIOLOGY OF *MYXOBOLUS INSIDIOSUS* WYATT AND PRATT, 1963 (PROTOZOA: MYXOSPORIDA). *J. Fish Dis.* 1(3):233-240. July 1978. SFA 25(2)
[Dep. Biol., Hamline Univ., St. Paul, MN 55104] *Myxobolus insidiosus* from the striated musculature of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), was studied in disease free and naturally contaminated waters. Infection could not be induced in susceptible fish in a disease free water supply by any means tried. Experiments in naturally contaminated waters provided data on minimum and other exposure times. Studies were also carried out on the effect of water temperature, different substrates and flow rates, time of the year and size of fish on infection. The rainbow trout, *Salmo gairdneri* Richardson, was also checked for infection and not found with this disease in naturally contaminated waters. Transovarian infection was ruled out.

80-001529 Yamamoto, T. and J. E. Sanders. LIGHT AND ELECTRON MICROSCOPIC OBSERVATIONS OF SPOROGENESIS IN THE MYXOSPORIDA, *CERATOMYXA SHASTA* (NOBLE, 1950). *J. Fish Dis.* 2(5):411-428. Sept. 1979. SFA 25(2)
[Dep. Microbiol., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

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80-001530 Ahne, W. UPTAKE AND MULTIPLICATION OF SPRING VIRAEMIA OF CARP VIRUS IN CARP, *CYPRINUS CARPIO* L. *J. Fish Dis.* 1(3):265-268. July 1978. SFA 25(2)
[Inst. Zool. Hydrobiol., Univ. Munich, Kaulbachstr. 37, 8 Munich 22, West Germany]

80-001531 Amin, O. M. LYMPHOCYSTIS DISEASE IN WISCONSIN FISHES. *J. Fish Dis.* 2(3):207-217. May 1979. SFA 25(2)
[Sci. Div., Univ. Wis., Kenosha 53141]

80-001532 Amlacher, E.; J. Ude; C. Rudolph and G. Ernst. DIRECT ELECTRON MICROSCOPICAL VISUALIZATION OF THE PRESUMPTIVE VIRUS OF VIRAL HAEMORRHAGIC SEPTICAEMIA (VHS) IN THE RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON AND ADDITIONAL HISTOPATHOLOGICAL AND HAEMATOLOGICAL OBSERVATIONS. *J. Fish Dis.* 3(1):55-62. Jan. 1980. SFA 25(2)
[Inst. Pathol. Friedrich-Schiller, Univ. Jena, DDR-69 Jena,

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80-001532 CONTINUED Ziegelmühlenweg 1, West Germany] Electron microscopical and histopathological investigations were carried out on the anterior kidney of ten 1-year-old farmed rainbow trout naturally infected with the external signs of viral haemorrhagic septicaemia (VHS). The histopathology of the liver and the haematology of peripheral blood were also examined. The presumptive virus of VHS was directly demonstrated for the first time in the anterior kidney. All diseased fishes showed necrotic changes in the kidney and the liver. The melano-macrophage centres of the anterior kidney showed a partial destruction accompanied with a loss of melanin. A progressive destruction of the erythrocytes was observed. The liver exhibited moderate to extensive necrosis (karyorrhexis and karyolysis with lymphocytic invasion in the necrotic areas). Neither intranuclear nor intracytoplasmatic inclusions were observed. In the peripheral blood diverse stages of erythrocytic degeneration, amitoses of the erythrocytes and a five-fold increase in lymphocyte numbers were observed.

80-001533 Buchanan, J. S. and C. R. Madeley. STUDIES ON *HERPESVIRUS SCOPHTHALMI* INFECTION OF TURBOT *SCOPHTHALMUS MAXIMUS* (L.) ULTRASTRUCTURAL OBSERVATIONS. *J. Fish Dis.* 1(4):283-295. Oct. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001534 Bucke, D.; J. Finlay; D. McGregor and C. Seagrave. INFECTIOUS PANCREATIC NECROSIS (IPN) VIRUS: ITS OCCURRENCE IN CAPTIVE AND WILD FISH IN ENGLAND AND WALES. *J. Fish Dis.* 2(6):549-553. Nov. 1979. SFA 25(2)
[Fish Dis. Lab., The Nothe, Weymouth, Dorset, England]

80-001535 Carlisle, J. C.; K. A. Schat and R. Elston. INFECTIOUS HAEMATOPOIETIC NECROSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN A SEMI-CLOSED SYSTEM. *J. Fish Dis.* 2(6):511-517. Nov. 1979. SFA 25(2)
[Dep. Avian Aquatic Med., N.Y. State Coll. Vet. Med., Cornell Univ., Ithaca 14853]

80-001536 Castric, J. and P. de Kinkelin. OCCURRENCE OF VIRAL HAEMORRHAGIC SEPTICAEMIA IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON REARED IN SEA-WATER. *J. Fish Dis.* 3(1):21-27. Jan. 1980. SFA 25(2)
[P. de Kinkelin: Lab. Ichtyopathol. Inst. Natl. Rech. Agon., 78850 Thiverval-Grignon, France] Viral haemorrhagic septicaemia (VHS) is reported for the first time in sea-water cultured rainbow trout. Heavy mortalities with typical signs and lesions occurred about 1 month after the trout were transferred from fresh to sea-water. A VHS virus (serotype 1) was isolated from the diseased fish. The mortalities were caused only by the VHS virus and 80 days post transfer of trout to sea-water the mortalities reached 85% of the initial population. The disease was experimentally transmitted to rainbow trout, both in sea-water and freshwater, either by immersing the fish in contaminated water containing $3 \cdot 10^4$ pfu/ml of virus or by intramuscular injection of various doses of VHS_1 ($7 \cdot 10^1$, $7 \cdot 10^4$ or $7 \cdot 10^6$ pfu per fish). Death occurred in all infected groups and started earlier in sea-water. Typical signs of VHS were observed in moribund fish. Viral multiplication was demonstrated to have occurred in fish organs.

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80-001537 Cleator, G. M. and L. A. Burney. THE HAEMAGGLUTINATING PROPERTIES OF INFECTIOUS PANCREATIC NECROSIS VIRUS. *Arch. Virol.* 63(2):81-85. 1980. SFA 25(2)
[Dep. Bacteriol. Virol., Univ. Manchester, Manchester, England]

80-001538 Dorson, M. and C. Torchy. COMPLEMENT DEPENDENT NEUTRALIZATION OF EGTVED VIRUS BY TROUT ANTIBODIES. *J. Fish Dis.* 2(4):345-347. July 1979. SFA 25(2)
[Lab. Ichtyo-pathol., INRA, Route Thiverval, 78850 Thiverval-Grignon, France]

80-001539 Dorson, M.; J. Castric and C. Torchy. INFECTIOUS PANCREATIC NECROSIS VIRUS OF SALMONIDS: BIOLOGICAL AND ANTIGENIC FEATURES OF A PATHOGENIC STRAIN AND OF A NON-PATHOGENIC VARIANT SELECTED IN RTG-2 CELLS. *J. Fish. Dis.* 1(4):309-320. Oct. 1978. SFA 25(2)
[Lab. Ichtyopathol., INRA, Route Thiverval, 78850, Thiverval, Grignon, France] A non-pathogenic cell culture adapted variant was obtained from a normally pathogenic strain of IPN virus (Sp type) after several passages in RTG-2 cells. This cell culture modified (CCA) strain was compared with the original wild (W) strain in various tests. Cross neutralization tests showed no obvious antigenic difference between the two. However the CCA strain was neutralized by a 1:5000 dilution of normal trout serum whereas the W strain was not. In RTG-2 cells, CCA strain gave both large and small plaques, whereas the W strain gave only small ones. Both virus strains were heat sensitive and labile to cyclic freezing and thawing. The CCA virus was more stable in storage at 4°C under different pH conditions and its growth in RTG-2 cells was more rapid. The rt (supra-optimal temperature at which viral yield is depressed by 90%) appeared to be 19-20°C for the CCA strain and 18-19°C for the W strain. Pre-treatment of RTG-2 cells with ultraviolet inactivated CCA virus, could inhibit growth of W virus, but had no effect on replication of homologous virus.

80-001540 Fijan, N. N. and G. Giorgetti. INFECTIOUS PANCREATIC NECROSIS: ISOLATION OF VIRUS FROM EYED EGGS OF RAINBOW TROUT *SALMO GAIRDNERI* RICHARSON. *J. Fish Dis.* 1(3):269-270. July 1978. SFA 25(2)
[Dep. Biol. Pathol. Fish Bees, Univ. Zagreb, 41001 Zagreb, POB 190, Yugoslavia]

80-001541 Hedrick, R. P.; J. C. Leong and J. L. Fryer. PERSISTENT INFECTIONS IN SALMONID FISH CELLS WITH INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV). *J. Fish Dis.* 1(4):297-308. Oct. 1978. SFA 25(2)
[J. L. Fryer: Dep. Microbiol., Nash Hall, Oreg. State Univ., Corvallis 97331] Two cell lines that are persistently infected with IPN virus have been established. Viral persistence in the cultures was demonstrated by the detection of infectious virus (10^2-$10^{5.5}$ $TCID_{50}$/ml) in the culture fluids, by specific immunoflourescence, and by their resistance to superinfection by homologous virus. The growth rate of these cells was indistinguishable from normal, uninfected cells. Virus stocks harvested from persistently infected cultures contained a greater proportion of defective, interfering particles than those from lytically infected cells which suggests that these particles may be responsible for the maintenance of these carrier cultures.

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80-001542 Hetrick, F. M.; J. L. Fryer and M. D. Knittel. EFFECT OF WATER TEMPERATURE ON THE INFECTION OF RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON WITH INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS. *J. Fish. Dis.* 2(3):253-257. May 1979. SFA 25(2)
[Dep. Microbiol., Univ. Md., College Park 20742]

80-001543 Nicholson, B. L.; G. W. Thorne, C. Janicki and A. Hanson. STUDIES ON A HOST RANGE VARIANT FROM DIFFERENT ISOLATES OF INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV). *J. Fish Dis.* 2(5):367-379. Sept. 1979. SFA 25(2)
[Dep. Microbiol., Univ. Me., Orono 04473] Eight isolates of infectious pancreatic necrosis virus (IPNV) propagated solely in RTG-2 cells (RTG-IPNV) were examined for ability to replicate in FHM cells. Seven isolates replicated in FHM cells; however, the plaque titres were 10- to greater than 100,000-fold less than titres in RTG-2 cells. The ability of IPNV to replicate in FHM cells was shown to result from the presence of a host range variant (FHM-IPNV) that produced plaques in both cell types. Variant-free preparations of two isolates differed in ability to generate FHM-IPNV during a single replication cycle in RTG-2 cells. One isolate did not generate the variant and failed to replicate in FHM cells even upon blind passage. IPNV propagated in AS cells (AS-IPNV) was similar to RTG-IPNV, producing equal numbers of plaques in RTG-2 and AS cells but failing to form plaques in FHM cells. However, IPNV propagated in BF-2 cells (BF-IPNV) was similiar to FHM-IPNV in producing equal numbers of plaques in all three cell lines. RTG-IPNV and FHM-IPNV were identical in size, morphology and density in CsCl but differed in plaque size distribution and neutralization by specific antiserum. Restriction of the replication of RTG-IPNV in FHM cells was partially explained by a reduction of 75% in adsorption to FHM cells. However, the synthesis of RTG-IPNV antigens was reduced 90 to > 99% in FHM cells.

80-001544 Plumb, J. A. and J. Chappell. SUSCEPTIBILITY OF BLUE CATFISH TO CHANNEL CATFISH VIRUS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:680-685. 1978[1979]. SFA 25(2)
[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830] The susceptibility of blue catfish, (*Ictalurus furcatus*), and reciprocal channel (*I. punctatus*) x blue catfish hybrids to channel catfish virus (CCV) was determined through several methods of exposure. Mortalities of blue catfish, when injected intraperitoneally with CCV, were similar to what would be expected with channel catfish. Histopathology of CCV-injected blue catfish did not deviate from that of similarly infected channel catfish. Infection of blue catfish and the hybrids by swabbing the gills, dipping fish in a virus solution, or by cohabitation with CCV-diseased fish were primarily ineffective. It is concluded that blue catfish and hybrids of channel catfish x blue catfish are as equally susceptible as channel catfish to injection of CCV but the blue catfish are refractive to the virus by more natural routes of transmission.

80-001545 Richards, R. H. and J. S. Buchanan. STUDIES ON *HERPESVIRUS SCOPHTHALMI* INFECTION OF TURBOT *SCOPHTHALMUS MAXIMUS* (L.): HISTOPATHOLOGICAL OBSERVATIONS. *J. Fish Dis.* 1(3):251-258. July 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] The histological features of the disease caused by infection of turbot by *Herpesvirus scophthalmi* are described. Infection of epidermal cells of skin and gill resulted in the formation of giant cells showing a variety of nuclear and cytoplasmic changes associated with the replication of the virus. The effects of the condition together with possible control measures are discussed.

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80-001546 Smail, D. A. and S. I. Egglestone. VIRUS INFECTIONS OF MARINE FISH ERYTHROCYTES: ELECTRON MICROSCOPICAL STUDIES ON THE BLENNY VIRUS. *J. Fish Dis.* 3(1):47-54. Jan. 1980. SFA 25(2)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] This paper reports for the first time the application of the direct negative staining technique for the rapid confirmation of the viral nature of blenny 'piscine erythrocytic necrosis' (PEN). The virus in negatively stained preparations has an internal core structure which appears in exact opposite contrast to that seen in thin sectioned virus. The resultant images from both negative staining and thin sectioning suggest that the organization of the core is unique amongst intracytoplasmic deoxyriboviruses (ICDVs).

80-001547 Smail, D. A. and S. I. Egglestone. VIRUS INFECTIONS OF MARINE FISH ERYTHROCYTES: PREVALENCE OF PISCINE ERYTHROCYTIC NECROSIS IN COD *GADUS MORNUA* L. AND BLENNY *BLENNIUS PHOLIS* L. IN COASTAL AND OFFSHORE WATERS OF THE UNITED KINGDOM. *J. Fish Dis.* 3(1):41-46. Jan. 1980. SFA 25(2)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] Giemsa stained blood smears prepared from blenn'es caught on the shores of southern England and from cod taken from the Celtic and North seas revealed fish with clinical 'piscine erythrocytic necrosis' (PEN). The findings recorded here extend the distribution data on PEN infections and report that the infection in the blenny and cod may possibly have a similar developmental pattern. Data are presented on the prevalence of the infection in the fish population samples and on the proportion of infected cells in the smears examined.

80-001548 Wolf, K. E.; M. C. Quimby; C. P. Carlson and W. J. Owens. LYMPHOCYSTIS VIRUS: INFECTIVITY OF LESION PREPARATIONS STORED AFTER LYOPHILIZATION OR SIMPLE DESICCATION. *J. Fish Dis.* 2(3):259-260. May 1979. SFA 25(2)
[U.S. FWS, Rt. 3, Box 50, Kearneysville, WV 25430]

OTHER DISEASES AND PARASITES

80-001549 Amin, O. M. EFFECT OF HOST SPAWNING ON *ECHINORHYNCHUS SALMONIS* MÜLLER, 1784 (ACANTHOCEPHALA: ECHINORHYNCHIDAE) MATURATION AND LOCALIZATION. *J. Fish. Dis.* 1(2):195-197. Apr. 1978. SFA 25(2)
[Sci. Div., Univ. Wis., Kenosha 53141]

80-001550 Bailey, W. C.; J. Ginal and L. G. Mitchell. VICERAL FIBROSIS IN BLUEGILLS IN CENTRAL IOWA. *Proc. Iowa Acad. Sci.* 87(1):24. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Iowa State Univ., Ames 50011] Unusually severe liver and visceral fibroses were observed in a population of bluegills (*Lepomis macrochirus*) from the Iowa State University Horticulture farm pond in Story County during 1977-79. The lesions were associated with heavy infections of metacercariae of the trematode, *Posthodiplostomum minimum*, and plerocercoids of *Proteocephalus ambloplitis*. Affected bluegills were from 3 to 7 years of age. Parasite loads were heavy, averaging 1700 metacercariae and 5 plerocercoids per host. Fibrotic lesions varying from scattered tubular branched foci in livers to massive adhesions throughout the viscera occurred in 60 (14.6%) of 411 bluegills examined during 1978-79. Lesions in 83% of these fish were melanotic. In section, severely affected livers consisted of islets of hepatocytes interspersed with rigid fibrotic cysts. Cysts were formed of concentric layers of dense fibers, often containing melanin granules and remnants of melanin macrophages. Central cores of cysts appeared empty or were partially filled by amorphous debris or metacercariae. Despite

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80-001550 CONTINUED the apparent severity of this condition and the heavy parasite loads, affected bluegills showed no obvious external signs of disease.

80-001551 Blasiola, G. C., Jr. and J. C. Turnier. ALGAL INFECTION OF THE SEVENGILL SHARK, *NOTORYNCHUS MACULATUS* AYRES. *J. Fish Dis.* 2(2):161-163. Mar. 1979. SFA 25(2)
[Steinhart Aquarium, Golden Gate Park, San Francisco, CA 94118]

80-001552 Bray, R. A. and D. I. Gibson. THE FELLODISTOMIDAE (DIGENEA) OF FISHES FROM THE NORTHEAST ATLANTIC. *Bull. Br. Mus. (Nat. Hist.) Zool.* 37(4):199-293. 28 Feb. 1980. SFA 25(2)
[Dep. Zool., Brit. Bull. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-001553 Bucke, D.; G. D. Cawley; J. F. Craig; A. D. Pickering and L. G. Willoughby. FURTHER STUDIES OF AN EPIZOOTIC OF PERCH *PERCA FLUVIATILIS* L., OF UNCERTAIN AETIOLOGY. *J. Fish. Dis.* 2(4):297-311. July 1979. SFA 25(2)
[A. D. Pickering: Freshwater Biol. Assoc., The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 0LP, England] The geographical distribution of an epizootic of perch *Perca fluviatilis* L., characterized by severe epidermal lesions and marked fish kills, is described. A wide variety of fungal and bacterial infections were found in diseased fish but the evidence suggests that they were not the primary cause of this condition. The primary pathogenic agent (assuming that it exists) or predisposing environmental factor has yet to be discovered. The severity of this disease is illustrated by monitoring the course of the epizootic in the perch population in Windermere. All age groups of fish were affected during the course of one year although the fish at spawning time appeared to be particularly vulnerable. There was a dramatic increase in the perch mortality in Windermere in 1976 and it is estimated that over 98% of the adult population (over 1 million fish) died in that year.

80-001554 Bullock, A. M. and R. J. Roberts. INDUCTION OF UDN-LIKE LESIONS IN SALMONID FISH BY EXPOSURE TO ULTRAVIOLET LIGHT IN THE PRESENCE OF PHOTOTOXIC AGENTS. *J. Fish Dis.* 2(5):439-441. Sept. 1979. SFA 25(2)
[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyl, PA34 4AD, Scotland]

80-001555 Bullock, A. M.; R. S. Batty and D. A. Neave. LIPOPHOROMATOSIS IN ADULT PLAICE *PLEURONECTES PLATESSA* L. *J. Fish Dis.* 2(6):567-568. Nov. 1979. SFA 25(2)
[Dunstaffnage Mar. Res. Lab., Oban, Argyllshire, Scotland]

80-001556 Carvajal, J.; P. E. Cattan; C. Castillo and P. Schatte. LARVAL ANISAKIDS AND OTHER HELMINTHS IN THE HAKE, *MERLUCCIUS GAYI* (GUICHENOT) FROM CHILE. *J. Fish Biol.* 15(6):671-677. Dec. 1979. SFA 25(2)
[Lab. Zool., Inst. Cienc. Biol., Univ. Católica de Chile, Casilla 114-D, Santiago, Chile]

OTHER DISEASES AND PARASITES

80-001557 Cattan, P. E.; J. Carvajal; D. Torres and J. L. Yáñez. PRIMERA COMUNICACIÓN SOBRE CESTODOS TRYPANORHYNCHA EN PECES DEL ARCHIPIÉLAGO DE JUAN FERNÁNDEZ. [FIRST REPORT ON TRYPANORHYNCHA CESTODES IN FISH FROM JUAN FERNÁNDEZ ARCHIPELAGO]. *Bol. Chil. Parasitol.* 34(1/2):44-46. 1979. In Spanish with English summ. SFA 25(2)
[Dep. Cienc. Pecuar. Bas., Fac. Med. Vet., Univ. Chile, Santiago, Chile]

80-001558 Conroy, D. A. and J. A. Santacana. A CASE OF GOITRE AND ITS TREATMENT IN A GOLDFISH *CARASSIUS AURATUS* (L.). *J. Fish Dis.* 2(6):555-556. Nov. 1979. SFA 25(2)
[Fac. Cienc. Vet., Univ. Cent. Venezuela, Apt. Correos No. 4563, Maracay, Edo. Aragua, Venezuela]

80-001559 Crowden, A. E. and D. M. Broom. EFFECTS OF THE EYEFLUKE, *DIPLOSTOMUM SPATHACEUM*, ON THE BEHAVIOUR OF DACE (*LEUCISCUS LEUCISCUS*). *Anim. Behav. (Baillière Tindall, Publ.)* 28(1):287-294. Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Reading, Reading RG6 2AJ, England]

80-001560 Dojiri, M. and P. S. Perkins. A NEW GENUS OF CYCLOPOID COPEPOD (CHONDRACANTHIDAE) PARASITIC ON HALIBUT FROM CALIFORNIA INSHORE WATERS. *J. Parasitol.* 65(5):794-803. Oct. 1979. SFA 25(2)
[Boston Univ. Mar. Prog., Mar. Biol. Lab., Woods Hole, MA 02543]

80-001561 Edwards, C. J. ALGAL INFECTIONS OF FISH TISSUE: A RECENT RECORD AND REVIEW. *J. Fish. Dis.* 1(2):175-179. Apr. 1978. SFA 25(2)
[Ohio Coop. Fish. Res. Unit, 1735 Neil Ave., Columbus 43210]

80-001562 Fahy, E. *EUBOTHRIUM CRASSUM* IN MIGRATORY TROUT, *SALMO TRUTTA* L., IN THE SEA. *J. Fish Biol.* 16(1):99-104. Jan. 1980. SFA 25(2)
[Rosminna, Drumree, Co. Meath, Ireland] The incidence and intensity of infection of various ages and conditions of migratory trout by *Eubothrium crassum* are described. A marine source of the worm seems likely and explanations for the characteristics of the parasite burden are given on this assumption. Within weeks of first going to sea the hosts accumulate large numbers of the parasites. One year suffices for the life cycle of *Eubothrium* but growth continues for at least two years and possibly for longer. The parasite burden decreases in older fish because of the stress imposed on the parasite by successive migrations of the host to and from fresh water and because older fish tend to feed earlier in the year.

80-001563 Ferguson, H. W. and H. J. Ball. EPIDEMIOLOGICAL ASPECTS OF PROLIFERATIVE KIDNEY DISEASE AMONGST RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN NORTHERN IRELAND. *J. Fish Dis.* 2(3):219-225. May 1979. SFA 25(2)
[Dep. Agric., Vet. Res. Lab., Stormont, Belfast BT4 3SD, Northern Ireland] The epidemiology of PKD is described as it relates to one affected farm in Northern Ireland. From 1972-1976 stocking and management practices led to mortality of 10-15% amongst the 0+ fish. 1+ or older fish were never affected. In 1977 and 1978, however, delaying the stocking of the farm until July eliminated deaths in the 0+ fish, and mortality in these 1977-moved fish the subsequent year remained at an absolute minimum. Preliminary observations suggest that a means of controlling the disease has been found. Experimental work demonstrates that the resistance of 1+ or older fish is due to previous exposure and is not an age-related immunity. Experimental work also suggests the presence of an incubation period of 6-7 weeks and that the peak time of

OTHER DISEASES AND PARASITES

80-001563 CONTINUED infectivity is probably around May. None of the evidence detracts from the possibility that an infectious agent is involved although an attempt to transmit the disease failed.

80-001564 Fischthal, J. H. *ASYMPHYLODORA FISHELSONI* SP. N. (TREMATODA: MONORCHIIDAE) FROM A CYPRINODONTID FISH, *APHANIUS DISPAR RICHARDSONI* (BOULENGER), FROM ISRAEL, AND ITS ALLOMETRIC GROWTH. *J. Helminthol.* 53(4):357-362. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., State Univ. N.Y., Binghampton 13901]

80-001565 Gibson, D. I. and R. A. Bray. *CIRKENNEDYA PORLOCKENSIS*, A NEW GENUS AND SPECIES OF DIGENEAN FROM THE SUNFISH *MOLA MOLA* (L.). *J. Helminthol.* 53(3):245-250. Sept. 1979. SFA 25(2)
[Zool. Dep., Brit. Mus. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-001566 Goil, M. M. and R. P. Harpur. A COMPARISON OF THE NON-SPECIFIC ACID PHOSPHOMONOESTERASE ACTIVITY IN THE LARVA OF *PHOCANEMA DECIPIENS* (NEMATODA) WITH THAT OF THE MUSCLE OF ITS HOST THE CODFISH (*GADUS MORHUA*). *Z. Parasitenkd.* 60(2):177-183. 1979. SFA 25(2)
[R. P. Harpur: Inst. Parasitol., McGill Univ., Macdonald Coll., Ste-Anne-de-Bellevue, PQ H9X 1C0, Canada]

80-001567 Haller, R. D. and R. J. Roberts. DUAL NEOPLASIA IN A SPECIMEN OF *SAROTHERODON SPILURUS SPILURUS* (GÜNTHER) (= *TILAPIA SPILURUS*). *J. Fish Dis.* 3(1):63-66. Jan. 1980. SFA 25(2)
[R. J. Roberts: Unit Aquatic Pathobiol., Inst. Aquacult., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001568 Hard, G. C.; R. Williams and J. Lee. HISTOPATHOLOGY OF SUPERFICIAL FISH 'TUMOURS' FOUND DURING A CANCER SURVEY OF DEMERSAL SPECIES IN PORT PHILIP BAY, VICTORIA, AUSTRALIA. *J. Fish Dis.* 2(6):455-467. Nov. 1979. SFA 25(2)
[Fels Res. Inst., Temple Univ., Sch. Med., 3420 N. Broad St., Philadelphia, PA 19140]

80-001569 Harrison, J. G. and R. H. Richards. THE PATHOLOGY AND HISTOPATHOLOGY OF NEPHROCALCINOSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARSON IN FRESH WATER. *J. Fish Dis.* 2(1):1-12. Jan. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] A detailed histopathological study of naturally occurring and experimentally induced outbreaks of nephrocalcinosis was carried out on rainbow trout from a number of farms. Histopathological effects were confined to the kidney, stomach and skeletal muscle. Lesions of the stomach wall were often found in the absence of renal lesions but muscle lesions were only found in the presence of severe renal damage. It was considered that the calcification was the result of deposition of calcium salts within necrotic tissue, and thus was dystrophic rather than metastatic. Variation between farms was considered to be due to variations in the effects of different aetiological factors in the complex series of physico-chemical events which appear to induce the condition.

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80-001570 Hayunga, E. G. OBSERVATIONS ON THE INTESTINAL PATHOLOGY CAUSED BY THREE CARYOPHYLLID TAPEWORMS OF THE WHITE SUCKER *CATOSTOMUS COMMERSONI* Lacépède. *J. Fish Dis.* 2(3):239-248. May 1979. SFA 25(2)
[Immunoparasitol. Dep., Naval Med. Res. Inst., Bethesda, MD 20014]

80-001571 Henderson-Arzapalo, A.; R. R. Stickney and D. H. Lewis. IMMUNE HYPERSENSITIVITY IN INTENSIVELY CULTURED *TILAPIA* SPECIES. *Trans. Am. Fish. Soc.* 109(2):244-247. Mar. 1980. SFA 25(2)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Stn. 77843]

80-001572 Heufelder, G. R. and P. J. Schneeberger. OCCURRENCE OF THE ACANTHOCEPHALAN *LEPTORHYNCOIDES THECATUS* IN SLIMY SCULPINS--A NEW HOST RECORD. *Trans. Am. Fish. Soc.* 109(1):142-144. Jan. 1980. SFA 25(2)
[Great Lakes Res. Div., Univ. Mich. Inst. Sci. Technol., Ann Arbor 48109]

80-001573 Hoffman, G. L. ASIAN TAPEWORM, *BOTHRIOCEPHALUS ACHEILOGNATHI* YAMAGUTI, 1934, IN NORTH AMERICA. *Fisch. Umwelt* 8:69-75. 1980. SFA 25(2)
[U.S. FWS, Fish Farm. Exp. Stn., Stuttgart, AR]

80-001574 Iwama, G. K. "ONE-EYE", A DISEASE OF RAINBOW TROUT (*SALMO GAIRDNERI*) AT THE KOOTENAY TROUT HATCHERY, BRITISH COLUMBIA. *British Columbia Minist. Recreation Conserv. Fish. Manage. Rep.* No. 42. 11p. 1979. SFA 25(2)

80-001575 Kruse, G. O. W. TREMATODES OF MARINE FISHES FROM SOUTH AUSTRALIA. 4. *HARVEYTRENA BISULCATUM* GEN. ET SP. N. (LEPOCREADIIDAE). *J. Parasitol.* 65(6):918-920. Dec. 1979. SFA 25(2)
[Univ. Nebr. State Mus., Lincoln 68588]

80-001576 Kruse, G. O. W. TREMATODES OF MARINE FISHES FROM SOUTH AUSTRALIA. 6. *MONOSTEPHANOSTOMUM MANTERI* GEN. ET SP. N. (ACANTHOCOLPIDAE). *J. Parasitol.* 65(6):921-923. Dec. 1979. SFA 25(2)
[Univ. Nebr. State Mus., Lincoln 68588]

80-001577 Lester, R. J. G. DESCRIPTIONS OF TWO NEW DIDYMOZOIDS FROM AUSTRALIAN FISHES. *J. Parasitol.* 65(6):904-908. Dec. 1979. SFA 25(2)
[Dep. Parasitol., Univ. Queensland, St. Lucia, Brisbane, Australia 4067]

80-001578 Llewellyn, J.; S. MacDonald and J. E. Green. HOST-SPECIFICITY AND SPECIATION IN DICLIDOPHORAN (MONOGENEAN) GILL PARASITES OF TRISOPTERAN (GADOID) FISHES AT PLYMOUTH. *J. Mar. Biol. Assoc. UK* 60(1):73-79. Feb. 1980. SFA 25(2)
[Dep. Zool. Comp. Physiol., Univ. Birmingham, P.O. Box 363, Birmingham, England] *Trisopterus minutus minutus* has been free of monogenean parasites for at least 25 years but in 1979 about 5% of Plymouth specimens have become parasitized by *Diclidophora esmarkii*. *D. esmarkii* was formerly thought to be indistinguishable morphologically from *d. luscae* which is a common parasite of *Trisopterus luscus* at Plymouth but a renewed comparison of *D. luscae* and *D. esmarkii* has revealed a diagnostic difference in the size of the attachment clamps, in the charasteristic number of eggs in the egg bundles, and in the relative development of the intra-pharyngeal glands. In 1979 there has been an influx into Plymouth water, presumably from more western and northern regions, of *Trisopterus esmarki*, bringing with it *D. esmarkii* and it is suggested that this parasite is less strictly species-specific than *D. luscae* and, given the opportunity, has now parasitized Plymouth *T. m. minutus*. It has not, however, colonized *T. luscus*.

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80-001579 MacDonald, S. and J. Llewellyn. REPRODUCTION IN *ACANTHOCOTYLE GREENI* N. SP. (MONOGENEA) FROM THE SKIN OF *RAJA* SPP. AT PLYMOUTH. *J. Mar. Biol. Assoc. UK* 60(1):81-88. Feb. 1980. SFA 25(2)
[Dep. Zool. Comp. Physiol., Univ. Birmingham, P.O. Box 363, Birmingham, England]

80-001580 Mahajan, C. L.; N. K. Agrawal; M. J. John and V. P. Katta. EFFECT OF THE DIGENEAN *ISOPARORCHIS HYPSELOBAGRI* (BILLET, 1898) ON AN AIRBREATHING FISH *CHANNA PUNCTATUS* (BLOCH) WITH PARTICULAR REFERENCE TO BIOCHEMICAL AND HAEMATOLOGICAL CHANGES. *J. Fish Dis.* 2(6):519-528. Nov. 1979. SFA 25(2)
[Dep. Zool., Univ. Rajasthan, Jaipur-302004, India]

80-001581 McArthur, C. P. HUMORAL ANTIBODY PRODUCTION BY NEW ZEALAND EELS, AGAINST THE INTESTINAL TREMATODE *TELOGASTER OPISTHORCHIS* MACFARLANE, 1945. *J. Fish Dis.* 1(4):377-387. Oct. 1978. SFA 25(2)
[Pathol. Dep., Coll. Med., Univ. Fla., Gainesville 32610]

80-001582 McVicar, A. H. and P. G. White. FIN AND SKIN NECROSIS OF CULTIVATED DOVER SOLE *SOLEA SOLEA* (L.). *J. Fish Dis.* 2(6):557-562. Nov. 1979. SFA 25(2)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

80-001583 Mills, C. A. ATTACHMENT AND FEEDING OF THE ADULT ECTOPARASITIC DIGENEAN *TRANSVERSOTREMA PATIALENSE* (SOPARKAR, 1924) ON THE ZEBRA FISH *BRACHYDANIO RERIO* (HAMILTON-BUCHANAN). *J. Fish Dis.* 2(5):443-447. Sept. 1979. SFA 25(2)
[Freshwater Biol. Assoc., River Lab., East Stoke, Wareham, Dorset BH20 6BB, England]

80-001584 Muroga, K.; T. Yoshimatsu and S. Kasahara. *UROCLEIDUS FEROX* (MONOGENEA: DACTYLOGYRIDAE) FROM BLUEGILL SUNFISH IN JAPAN. *Bull. Jpn. Soc. Sci. Fish.* 46(1):27-30. Jan. 1980. SFA 25(2)
[Fac. Appl. Biol. Sci., Hiroshima Univ., Fukuyama 720, Japan]

80-001585 Nammalwar, P. A NOTE ON HYPEROSTOSIS IN THE PERCH *POMADASYS HASTA* (BLOCH). *Indian J. Fish.* 23(1/2):247-249. 1976. SFA 25(2)
[Bombay Res. Cent. C.M.F.R. Inst., Bombay 400001, India] A case of hyperostosis in the skull bones of the perch, *Pomadasys hasta*, is reported. The oval-shaped protuberance of frontal and supraoccipital bones of the skull and also a small depression between the eyes are very prominent. This gives to the skull a hump-like appearance.

80-001586 Paperna, I.; I. Sabnai and M. Castel. ULTRASTRUCTURAL STUDY OF EPITHELIOCYSTIS ORGANISMS FROM GILL EPITHELIUM OF THE FISH *SPARUS AURATA* (L.) AND *LIZA RAMADA* (RISSO) AND THEIR RELATION TO THE HOST CELL. *J. Fish Dis.* 1(2):181-189. Apr. 1978. SFA 25(2)
[H. Steinitz Mar. Lab., Elat, Israel]

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80-001587 Peters, G. and N. Peters. THE INFLUENCE OF SALINITY ON GROWTH AND STRUCUTRE OF EPIDERMAL PAPILLOMAS OF THE EUROPEAN EEL *ANGUILLA ANGUILLA* L. *J. Fish. Dis.* 2(1):13-26. Jan. 1979. SFA 25(2)
[Inst. Hydrobiol. Fischereiwiss. Univ., Olbersweg 24, 2 Hamburg 50, West Germany] Papillomatosis of the European eel *Anguilla anguilla* L. occurs predominantly in waters of low to medium salinity (3-20 °/oo). Tumour-bearing eels were kept under laboratory conditions for several weeks in salt concentrations of 8, 15 and 30 °/oo. As opposed to those kept in freshwater, the experimental animals showed significant decreases in tumour growth rate. At the same time the tumour tissue underwent a marked redifferentiation, i.e. the originally poorly differentiated neoplastic tissue developed numerous mucous and club cells. The characteristic intercellular spaces of tumorous tissue disappeared with the formation of regular membrane interdigitations between adjacent cells. The nucleus to cytoplasm ratios of the neoplastic cells decreased to one-third of those of the untreated tumour. These changes resulted in a reversion of the neoplastic tissue to a structural condition essentially similar to that of normal epidermis. After a period of 2 to 3 months an adaptation to the altered salinity of the external medium was evident in that the tumorous tissue began to return to its original state.

80-001588 Piavis, G. W.; T. Beckerman and J. H. Howell. TERATOID LESIONS AND OTHER DEVELOPMENTAL ANOMALIES IN THE SEA LAMPREY, *PETROMYZON MARINUS* L. *J. Fish Dis.* 2(5):353-366. Sept. 1979. SFA 25(2)
[Dep. Anat., Baltimore Coll. Dental Surg., Dental Sch., Univ. Md., Baltimore 21201]

80-001589 Price, W. W. and R. A. Schlueter. OCCURRENCE OF THE PARASITE, *LIRONECA OVALIS* (ISOPODA: CYMOTHOIDAE) ON THE FISHES OF MCKAY BAY, TAMPA BAY SYSTEM, FL. *Fla. Sci.* 43(Suppl. 1):26. 1980. Abstract only. SFA 25(2)
[Univ. Tampa, Tampa, FL 33606] The isopod parasite, *Lironeca ovalis*, infested the gill cavities of 7 of 30 species of fish taken in biweekly seine collections from May 1977 to August 1978 in McKay Bay. The pinfish, *Lagodon rhomboides*, had the highest incidence rate (14.4%) followed by *Cyprinodon variegatus*, *Fundulus similis*, *Sciaenops ocellata*, *Leiostomus xanthurus*, *Floridicthys carpio* and *Fundulus grandis* (each <1%). Fish were infested from May-August only and incidence rates were highest in May and June for most species. Only female *L. ovalis* infested *L. rhomboides* and were most common on juveniles between 30-60 mm (SL). Over 50% of the females were ovigerous and carried 15 to 76 eggs/young per brood.

80-001590 Priemer, J. DARMHELMINTHEN VON *PERCA FLUVIATILIS* L. UND *ACERINA CERNUA* (L.) (PISCES) AUS GEWÄSSERN DER BERLINER RANDGEBIETES. [GUT HELMINTHS OF PERCH, *PERCA FLUVIATILIS* L. AND POPE, *ACERINA CERNUA* (L.) (PISCES) FROM LAKES ON THE OUTSKIRTS OF BERLIN.] *Zool. Anz.* 203(3/4):241-253. 1979. In German with English summ. SFA 25(2)
[Akad. Wissenschaften DDR, Berlin, West Germany]

80-001591 Raikova, E. V.; V. Ch. Suppes and G. L. Hoffman. THE PARASITIC COELENTERATE, *POLYPODIUM HYDRIFORME* USSOV, FROM THE EGGS OF THE AMERICAN ACIPENSERIFORM *POLYODON SPATHULA*. *J. Parasitol.* 65(5):804-810. Oct. 1979. SFA 25(2)
[Inst. Cytol. Acad. Sci., Leningrad 190121, USSR]

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80-001592 Rau, M. E.; D. M. Gordon and M. A. Curtis. BILATERAL ASYMMETRY OF *DIPLOSTOMUM* INFECTIONS IN THE EYES OF LAKE WHITEFISH *COREGONUS CLUPEAFORMIS* (MITCHILL) AND A COMPUTER SIMULATION OF THE OBSERVED METACERCARIAL DISTRIBUTION. *J. Fish Dis.* 2(4):291-297. July 1979. SFA 25(2)
[Inst. Parasitol., McGill Univ., Macdonald Coll. P.O. PQ H9X 1C0, Canada]

80-001593 Roald, S. O. and T. Håstein. LYMPHOSARCOMA IN AN ATLANTIC SALMON *SALMO SALAR* L. *J. Fish Dis.* 2(3):249-251. May 1979. SFA 25(2)
[Natl. Vet. Inst., P.B. 8156, Oslo 1, Norway]

80-001594 Roberts, R. J. and A. M. Bullock. PAPILLOMATOSIS IN MARINE CULTURED RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 2(1):75-77. Jan. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001595 Roberts, R. J.; R. H. Richards and A. M. Bullock. PANSTEATITIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON: A CLINICAL AND HISTOPATHOLOGICAL STUDY. *J. Fish Dis.* 2(2):85-92. Mar. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] Pansteatitis is a nutritionally mediated condition associated with the feeding of certain types of fish oil or unsaturated fatty acids of fish origin in a diet poor in vitamin E. It occurs regularly in mink, cats, pigs and poultry, all of which are fed on high fish diets, but this is the first description of the condition from cultured fish. The main presenting signs in affected rainbow trout were swimming aberrations, discolouration and high mortality after minimal stress. Gross post-mortem features were restricted to changes in the liver and swimbladder but, at the microscopic level, histopathological changes involving inflammatory cellular infiltration of lipid tissue in swimbladder, abdominal and peripancreatic fat and hypodermis, accompanied by myopathic changes, were regularly observed.

80-001596 Rollwagen, J. and D. Stainken. ECTOPARASITES AND FEEDING BEHAVIOR OF THE BLACKNOSE DACE, *RHINICHTHYS ATRATULUS* (CYPRINIDAE: CYPRINOFORMES) HERMANN. *Am. Midl. Nat.* 103(1):185-190. Jan. 1980. SFA 25(2)
[Dep. Biol., Manhattan Coll., Bronx, NY 10471]

80-001597 Sakaguchi, H. and A. Hamaguchi. [PHYSIOLOGICAL STUDIES ON CULTURED RED SEA BREAM--IV. PREVENTION OF GREEN LIVER AND CHANGES IN PLASMA CONSTITUENTS AND ENZYMATIC ACTIVITIES ON WINTER CULTURING IN WARM WATER.] *Bull. Jpn. Soc. Sci. Fish.* 45(11):1371-1373. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Fac. Fish., Nagasaki Univ., Nagasaki 852, Japan] Separate groups of red sea bream, *Chrysophrys major*, were kept in cold water of an ambient temperature of 7.7-12.9°C and in warm water controlled at 18.0-19.5°C. After 5 and 11 weeks, the incidence of green liver was checked, and some of the chemical components and enzymatic activities of the plasma were analyzed. The incidence of green liver in the fish maintained at the elevated temperature was much less than that in the fish maintained in the natural cold environment. The cold water fish showed higher levels of triglyceride and higher glutamate-oxalacetate transaminase and lactate dehydrogenase activities even though results varied widely among individuals within a group. Alkaline phosphatase and inorganic phosphate levels were higher in the warm water fish. The levels of total cholesterol, glucose, calcium, and magnesium were approximately the same for both groups.

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80-001598 Schram, T. A. THE LIFE HISTORY OF THE EYE-MAGGOT OF THE SPRAT, *LERNAEENICUS SPRATTAE* (SOWERBY) (COPEPODA, LERNAEOCERIDAE). *Sarsia* 64(4):279-316. 1979. SFA 25(2)
[Inst. Marinbiol. Limnol., Univ. Oslo, P.O. Box 1064, Blindern, Oslo 3, Norway]

80-001599 Scott, A. L. and J. M. Grizzle. PATHOLOGY OF CYPRINID FISHES CAUSED BY *BOTHRIOCEPHALUS GOWKONGENSIS* YEA, 1955 (CESTODA: PSEUDOPHYLLIDEA). *J. Fish. Dis.* 2(1):69-73. Jan. 1979. SFA 25(2)
[J. M. Grizzle: Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

80-001600 Simpson, D. T. and J. L. McGraw, Jr. TWO NEW GENERA OF ASPIDOGASTERIDAE FROM *POGONIAS CROMIS* (L.) FROM THE TEXAS GULF COAST. *Southwest. Nat.* 24(4):557-562. 10 Dec. 1979. SFA 25(2)
[Dep. Immunol., Helena Lab., Beaumont, TX 77704]

80-001601 Sjöblom, V. and E. Kuittinen. *PHOCASCARIS* SP. (NEMATODA) LARVAE IN BALTIC HERRING, A NEW PARASITE FOR THE BALTIC SEA. *Finn. Fish. Res.* 2:1-3. 1978. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O.B. 193, SF-00131, Helsinki 13, Finland] Since larvae of *Anisakis* sp. (Nematoda) are frequently found in herring from the Southern Baltic Sea a search was made for parasite in fish caught off the Finnish coast. In all 3,500 Baltic herring were inspected after treatment with citric acidpepsin, but no *Anisakis* larvae were found. However, some fish contained larvae of *Phocascaris* sp. (Nematoda) a parasite new to the Baltic Sea. The prevalence of the species seems to be small, only 29 larvae were found.

80-001602 Sjöblom, V. and E. Kuittinen. FURTHER FINDS OF LARVAE OF *PHOCASCARIS* SP. (NEMATODA) IN BALTIC HERRING OFF THE COAST OF FINLAND. *Finn. Fish. Res.* 2:19-21. 1978. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O.B. 193, SF-00131, Helsinki 13, Finland]

80-001603 Smart, G. R.; D. Knox; J. G. Harrison; J. A. Ralph; R. H. Richards and C. B. Cowey. NEPHROCALCINOSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO_2 CONCENTRATIONS. *J. Fish Dis.* 2(4):279-289. July 1979. SFA 25(2)
[Shearwater Fish Farming, 109/111 Lowther St., Carlisle, Cumbria, England] Rainbow trout exposed to environmental free CO_2 concentrations ranging from 12-60 mg/l for a minimum of 275 days developed nephrocalcinosis. Gross histopathological and chemical examinations demonstrated that prevalence and severity of nephrocalcinosis increased with increasing CO_2 concentrations. The condition was characterized by calcification and granuloma formation in kidney and stomach. Diet, but not water, PO_4-P concentration appeared to modify the prevalence and severity at each CO_2 concentration tested.

80-001604 Smith, A. C. FORMATION OF LETHAL BLOOD CLOTS IN FISHES. *J. Fish Biol.* 16(1):1-4. Jan. 1980. SFA 25(2)
[Oceanoic Inst., Makapuu Point, Waimanalo, HI 96795]

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80-001605 Smith, C. E. THE PREVENTION OF LIVER LIPOID DEGENERATION (CEROIDOSIS) AND MICROCYTIC ANAEMIA IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON FED RANCID DIETS: A PRELIMINARY REPORT. *J. Fish Dis.* 2(5):429-437. Sept. 1979. SFA 25(2)

[U.S. FWS, Fish Cult. Dev. Cent., Bozeman, MT 59715] Feeding a rancid diet deficient in Vitamins C and E to 13 g rainbow trout resulted in growth depression, microcytic anaemia and liver lipoid generation. Trout fed the rancid diet containing Vitamins C and E grew as well as control fish fed a non-rancid diet and did not develop microcytic anaemia or liver lipoid degeneration. The symptoms that developed in deficient fish are typical of those resulting from Vitamin E but not Vitamin C deficiency. The results suggest that Vitamin E is important in preventing growth depression, microcytic anaemia and liver lipoid degeneration in rainbow trout fed rancid diets.

80-001606 Smith, C. E.; T. H. Peck; R. J. Klauda and J. B. McLaren. HEPATOMAS IN ATLANTIC TOMCOD *MICROGADUS TOMCOD* (WALBAUM) COLLECTED IN THE HUDSON RIVER ESTUARY IN NEW YORK. *J. Fish Dis.* 2(4):313-320. July 1979. SFA 25(2)

80-001607 Tareen, I. U. ABSCESSED BONY AREAS ON *ACANTHOPAGRUS CUVIERI* (DAY) AS A SUBSTRATE FOR EPIPHYTIC ALGAE. *J. Fish Biol.* 16(2):145-148. Feb. 1980. SFA 25(2)

[Maricult. Fish Dep., Kuwait Inst. Sci. Res., P.O. Box 36825, Raas, Kuwait] *Enteromorpha compressa* (L.) Greville and *E. clathrata* (J. Agardh), widely distributed green algae in Arabian Gulf, were observed growing on *Acanthopagrus cuvieri* (Day). Abscessed areas on the operculum provided suitable sites for attachment of both species of algae; broken spine tips were preferred by *E. compressa*. This study showed that these algae preferred hard substrata, with no scales for attachment. *E. compressa* appeared earlier and grew faster. The condition of the fish was normal.

80-001608 Valtonen, E. T. *NEOECHINORHYNCHUS RUTILI* (MÜLLER, 1780) (ACANTHOCEPHALA) IN THE WHITEFISH *COREGONUS NASUS* (PALLAS) *SENSU* SVÄRDSON FROM THE BAY OF BOTHNIA. *J. Fish Dis.* 2(2):99-103. Mar. 1979. SFA 25(2)

[Dep. Zool., Univ. Oulu, Kasarmintie 8, 90100 Oulu 10, Finland]

80-001609 Wales, J. H. INDUCTION OF HEPATOMA IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON BY THE EGG BATH TECHNIQUE. *J. Fish Dis.* 2(6):563-566. Nov. 1979. SFA 25(2)

[4390 Crescent Valley Dr., Corvallis, OR 97330]

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80-001610 Lindén, O.; R. Elmgren and P. Boehm. THE *TSESIS* OIL SPILL: ITS IMPACT ON THE COASTAL ECOSYSTEM OF THE BALTIC SEA. *Ambio* 8(6):244-253. 1979. SFA 25(2)

[Swed. Water Air Pollut. Res. Inst., Studsvik, S-611 82 Nyköping, Sweden]

POLLUTION

80-001611 Byers, S. C. and R. O. Brinkhurst, eds. REPORT ON OCEAN DUMPING R AND D PACIFIC REGION DEPARTMENT OF FISHERIES AND OCEANS 1978-1979. *Pac. Mar. Sci. Rep.* 79-18. iv + 59p. 1979. SFA 25(2)
[Dobrocky Seatech Ltd., Sidney, British Columbia, Canada]

80-001612 Cairns, T. and C. H. Parfitt. PERSISTENCE AND METABOLISM OF TDE IN CALIFORNIA CLEAR LAKE FISH. *Bull. Environ. Contam. Toxicol.* 24(4):504-510. Apr. 1980. SFA 25(2)
[Food Drug Admin., U.N. Plaza Fed. Off. Bldg., San Francisco, CA 94102]

80-001613 Casne, S. R.; J. G. Goyert and D. F. Hanson. ASSESSING THE IMPACT OF POWER PLANTS ON STRIPED BASS (*MORONE SAXATILIS*) IN THE SACRAMENTO-SAN JOAQUIN DELTA. *Cal-Neva Wildl.* 1979:69-73. 1979. SFA 25(2)
[Ecological Analysts, Inc., 1910 Olympic Blvd., Walnut Creek, CA 94596] A strategy for assessing the impact of power plants on striped bass (*Morone saxatilis*) of the Sacramento-San Joaquin river system is presented. The Strategy is divided into three assessment categories: 1) Direct involvement, 2) Short-term response, and 3) Long-term population consequences. Measures of impact within each of these categories are discussed with reference to theoretical development and data requirements. The end product of this strategy is a systems approach to impact assessment which places the role of the power plants in perspective to the behavior of the entire system.

80-001614 Cox, G. V.; A. Barnett; J. R. Gould; K. G. Hay; J. Hirota; C. D. McAuliffe and A. D. Michael. OIL SPILL STUDIES: STRATEGIES AND TECHNIQUES. *J. Environ. Pathol. Toxicol.* 3(1/2):1-148. Dec. 1979. SFA 25(2)

80-001615 Crandall, P. S. EVALUATION OF STRIPED BASS X WHITE BASS HYBRIDS IN A HEATED TEXAS RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:588-598. 1978[1979] SFA 25(2)
[Tex. Parks Wildl. Dep., Ingram 78025] This study was conducted to identify habitat factors responsible for the success or failure of a striped bass (*Morone saxatilis*) x white bass (*Morone chrysops*) hybrid introduction and to measure fisherman benefits from the stocking. Hybrids were introduced into Lake Bastrop, Texas, at a rate of approximately 25 fish/ha in 1973, 1974, and 1975. From 1973 through 1977 water samples were analyzed to monitor physicochemical conditions; seining, gillnetting and cove rotenone sampling were accomplished to estimate composition of fish populations; and creel surveys were conducted to measure fisherman effort and harvest. Hybrids exhibited high survival rates but apparently there was insufficient forage to sustain their initial rapid growth. Despite this condition, hybrids attained weights up to 2.0 kg and provided substantial fisherman benefits in terms of harvest and recreation. The monetary value of these benefits was approximately 12 times greater than the costs of the hybrid introduction.

80-001616 Cumbie, P. M. and S. L. Van Horn. SELENIUM ACCUMULATION ASSOCIATED WITH FISH MORTALITY AND REPRODUCTIVE FAILURE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:612-624. 1978[1979]. SFA 25(2)
[Design Eng. Dep., Duke Power Co., P.O. Box 33189, Charlotte, NC 28242] Fish populations of Belews Lake, North Carolina, declined during the period of operation of the Belews Creek Steam Station from 1974 through 1977. Reproduction of fish in the main lake was almost completely absent in 1976 and 1977. A survey of trace elements in water and fish from Belews Lake indicated that selenium concentrations were elevated in Belews Lake water, and that fish in the lake had accumulated unusual amounts of selenium. Fish from a remote area of Belews Lake where normal reproduction took place in 1976 and 1977 had much lower selenium concentrations in their tissues than

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80-001616 CONTINUED fish from the main basin. Only trace elements of selenium occur naturally in water, soil, or mineral deposits in the Belews Lake drainage. Selenium entered Belews lake in soluble form by way of the power plant fly ash sluice water return. Selenium concentrations in Belews Lake water were not high enough to be directly toxic to fish. Uptake by plankton introduced selenium to the food chain where it ultimately reached elevated levels in fish due to bioaccumulation. Selenium is known to interfere with reproduction in animals, and is considered to be the most probable cause of reduced fish reproduction in Belews Lake. The North Carolina Department of Natural Resources and Community Development and Duke Power Company have taken action to reduce inputs of selenium to Belews Lake.

80-001617 Doyle, R. T.; J. V. Merriner and M. E. Bender. DEPURATION OF KEPONE BY ATLANTIC CROAKER IN A LABORATORY STUDY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:514-516. 1978[1979]. SFA 25(2)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, 23062] Contamination of the James River in Virginia by the organochlorine pesticide Kepone® prompted depuration studies of commercially important species. Approximately 400 croaker (*Micropogonias undulatus*) were taken from the James River and placed in Kepone-free York River water. Groups of 20 fish, maintained at ambient temperature, were sampled over time to determine depuration rate. Results suggest that there is no substantial depuration of Kepone by croaker until water temperature exceeds 15 C.

80-001618 Eagle, R. A.; P. A. Hardiman; M. G. Norton; R. S. Nunny and M. S. Rolfe. THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 5. THE DISPOSAL OF SOLID WASTES OFF THE NORTH-EAST COAST OF ENGLAND. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 51. 34p. 1979. SFA 25(2)
[M. G. Norton: Fish. Lab., Burnham-on-Crouch, England]

80-001619 Finlayson, B. and D. Wilson. ACID-MINE WASTE--HOW IT AFFECTS KING SALMON IN THE UPPER SACRAMENTO RIVER. *Outdoor Calif.* 40(6):8-12. Nov.-Dec. 1979. SFA 25(2)
[Calif. Dep. Fish Game, Water Pollut. Control Lab., Rancho Cordova]

80-001620 Folmar, L. C. EFFECTS OF SHORT-TERM FIELD APPLICATIONS OF ACROLEIN AND 2,4-D (DMA) ON FLAVOR OF THE FLESH OF RAINBOW TROUT. *Bull. Environ. Contam. Toxicol.* 24(2):217-224. Feb. 1980. SFA 25(2)
[U.S. FWS, Fish-Pestic. Res. Unit, Denver Fed. Cent., Denver, CO 80225]

80-001621 Forester, R. T. GEOTHERMAL ENERGY AND THE ENVIRONMENT. *Cal-Neva Wildl.* 1979:78-82. 1979. SFA 25(2)
By the year 2020 the world's presently identified oil reserves will be depleted. The United States has developed a National Energy Plan to conserve remaining oil supplies, reduce dependency on foreign oil supplies, and develop non-conventional energy sources, including geothermal. Geothermal energy could account for 4% of the nation's electrical energy production by 1990. Geothermal resources can be divided into the following types a) vapor dominated, b) liquid dominated, c) geopressure, d) hot dry rock, and e) Magma. Approximately 1.4 million ha of land have been designated by the U.S. Geological Survey as Known Geothermal Resource Areas (KGRA). California and Nevada account for 60% of the KGRA lands. 502 mw of electrical energy is now

80-001621 CONTINUED being produced at the Geysers KGRA. To operate one 110 mw geothermal power plant in The Geysers requires between 16-35 steam wells producing a total of 900,000 kgs of steam per hour for the 30 year life of the plant. The 110 mw power plant and attendant steam wells encompasses about 280 ha of land. Direct utilization of geothermal energy (nonelectric) is in its infancy in the United States. Geothermal resources with temperature less than 150 C can be used for greenhousing, fruit and vegetable dehydration space heating and aquaculture. The statement that geothermal energy production is nonpolluting is not entirely correct. Geothermal energy development has inherent restrictions and environmental problems, including site specificity; heat loss during steam/fluid transmission; extensive road, steam and electric transmission line networks; moderate land disturbance, up to 20% of the surface area, and potential air and water quality tradeoffs. Mitigation measures for wildlife habitat losses are generally restricted to revegetation of some denuded areas. In order to better assess the impacts to fish and wildlife resources resulting from geothermal development, baseline data are needed prior to exploration and development activities.

80-001622 Gover, J. W. CONCENTRATIONS OF ARSENIC, SELENIUM AND TEN HEAVY METALS IN SCHOOL SHARK, *GALEORHINUS AUSTRALIS* (MACLEAY), AND GUMMY SHARK, *MUSTELUS ANTARCTICUS* GÜNTHER, FROM SOUTH-EASTERN AUSTRALIAN WATERS. *Aust. J. Mar. Freshwater Res.* 30(4):505-510. Aug. 1979. SFA 25(2)

[Fish. Wildl. Div., Arthur Rylah Inst. Environ. Res., Brown St., Heidelberg, Victoria 3084, Australia] The maximum concentrations of arsenic, cadmium, copper, manganese, selenium and zinc in the edible flesh of *G. australis* and *M. antarcticus* were found to be 30, 0.08, 0.6, 0.6, 0.8 and 4.8 µg/g, wet weight respectively. The concentrations of cobalt, chromium, lead, molybdenum and nickel were below the limits of detection, namely 0.3, 0.5, 0.1, 0.2 and 0.2 µg/g, wet weight respectively, of the methods used. Samples for analysis were taken from one male and one female shark of each species caught in six areas in south-eastern Australian waters and wherever possible the concentrations of the elements were correlated with the sharks' species, sex and site of capture.

80-001623 Harrell, R. D.; R. L. Fuller and T. J. Edwards. AN INVESTIGATION OF THE FISH COMMUNITY OF BELEWS LAKE, NORTH CAROLINA. *Duke Power Co., Charlotte, N. C.* DUKE PWR/78-07. 64p. Oct. 1978. SFA 25(2)

[Duke Power Co., Charlotte, NC] Belews Lake provides a source of cooling water for the Belews Creek Steam Station (BCSS) located in Stokes County, North Carolina. This study, begun in 1976, was a continuation of a fish population evaluation study initiated by the North Carolina Wildlife Resources Commission (NCWRC) in 1971. This study revealed that the upper area of Belews Lake sustains an abundant and diverse adult and larval fish community, while the lower Belews Lake area supports few adult and larval fishes and exhibits little species diversity. Effects of the BCSS thermal discharges on the fishes of Belews Lake were limited to a general avoidance of the heated areas during the summer and fall months. Belews Lake flat bullheads generally grew faster and weighed slightly more than Lake Norman bullheads. Belews Lake bluegill grew slightly slower than those of most other North Carolina lakes and consistently weighed less than fish of equal lengths from other waters. Flat bullheads, green sunfish, and bluegill fed mainly on aquatic invertebrates (primarily insects).

80-001624 Haynes, R. J. THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977 AND POTENTIAL IMPACTS ON FISH AND WILDLIFE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:790-796. 1978[1979] SFA 25(2)

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80-001624 CONTINUED
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830] The Surface Mining Control and Reclamation Act of 1977 was enacted into law on 3 August 1977. Successful implementation and enforcement of the environmental performance standards of the Act will reduce or eliminate many of the previously recognized environmental perturbations of surface mining, and will result in numerous positive benefits for fish and wildlife. However, fish and wildlife will continue to be adversely affected by surface mining due to losses of specific habitat types and reclamations which result in postmining changes in habitat type and interspersion of habitats. The proposed program for reclaiming abandoned mine lands has great potential for benefiting fish and wildlife, but the actual benefit or loss will depend upon the conditions of each mine site and the site-specific reclamation plan authorized. Knowledgeable personnel within fish and wildlife management agencies will be charged with most of the responsibility for ensuring protection and equal consideration for the needs of fish and wildlife in proposed reclamation plans.

80-001625 Hubert, W. A. ALDRIN AND DDT RESIDUES IN CARP FROM IMPOUNDED AND RIVERINE SEGMENTS OF THE DES MOINES RIVER, 1979. *Proc. Iowa Acad. Sci.* 87(1):12. Mar. 1980. Abstract only. SFA 25(2)
[Iowa Coop. Fish. Res. Unit, Iowa State Univ., Ames 50011]

80-001626 Jacobsen, O. J. NOEN SYNSPUNKTER PÅ FORHOLDET FISK-SURT VANN. [SOME ASPECTS OF THE RELATION BETWEEN FISH AND ACID WATER] *Fauna (Oslo)* 31(1)1-10. 1978. In Norwegian with English summ. SFA 25(2)
[Zool. Inst., Box 1050, Univ. Oslo, Blindern, Oslo 3, Norway]

80-001627 Kauffman, J. EFFECT OF A MERCURY-INDUCED CONSUMPTION BAN ON ANGLING PRESSURE: SOUTH FORK OF THE SHENANDOAH RIVER, VIRGINIA. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):10-12. Jan.-Feb. 1980. SFA 25(2)
[P.O. Box 66, Free Union, VA 22940] Consumption of fish from the South Fork of the Shenandoah River was banned in June 1977 as a result of high mercury levels in the fish. Fishing pressure declined dramatically after the ban's announcement. Pressure decreased by 74% the first year, and economic losses to local communities amounted to more than $432,000. However, by the beginning of the second year fishing pressure had returned nearly to normal.

80-001628 Kureishy, T. W.; M. D. George and R. S. Gupta. TOTAL MERCURY CONTENT IN SOME MARINE FISH FROM THE INDIAN OCEAN. *Mar. Pollut. Bull.* 10(12):357-360. Dec. 1979. SFA 25(2)
[Natl. Inst. Oceanogr., Dona Paula, Goa 403 004, India] Total mercury was estimated in liver, gonads and muscle of some of the marine fishes from the Indian Ocean. The highest mercury concentration was observed in the muscle of sharks while the total mercury concentration was practically non-detectable in the liver and gonads. The range of all the values was 0.09-0.21 ppm (wet weight basis) and is quite low to reflect any possible mercury contamination.

80-001629 Lanigham, M. C. ZINC DYNAMICS IN AN ARTIFICIAL FRESHWATER ECOSYSTEM. *Ph.D. dissertation, State Univ. N.Y. (Buffalo)* 251p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4103. Mar. 1980. SFA 25(2)

80-001630 Lewis, W. M., Jr. and M. C. Grant. ACID PRECIPITATION IN THE WESTERN UNITED STATES. *Science* 207(4427):176-177. 11 Jan. 1980. SFA 25(2)
[Dep. Environ. Popul. Organ. Biol., Univ. Colo., Boulder 80309]

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80-001630 CONTINUED Precipitation chemistry data from a rural area at an elevation of 2900 meters near the Continental Divide in Colorado show unexpectedly low pH values for bulk precipitation. A significant downward trend in pH over the last 3 years is associated with increasing amounts of nitric acid in precipitation.

80-001631 Marble, A. D. IDENTIFICATION AND ASSESSMENT OF AQUATIC RESOURCES FOR POWER PLANT SITES ON MARYLAND'S EASTERN SHORE. *Coast. Zone Manage. J. (Copywrite Crane, Russak & Co., N.Y.)* 7(1):49-70. 1980. SFA 25(2)

[Rogers & Golden, Philadelphia, PA] A power plant siting procedure which accounts for the protection and preservation of aquatic resources, defined as sensitive life forms and life stages of economically valuable species of finfish and shellfish, is presented as it was executed on Maryland's Eastern Shore. Negative effects of power plant development and operation are generated principally by the cooling water intake and discharge system. The site-selection procedure is thus presented as a two-faceted process, termed regional screening, requiring the separate but simultaneous identification of land-based sites and cooling systems. Criteria included in regional screening for cooling systems reflected life-sustaining processes essential to the maintenance of aquatic resources. Major sources of effects of power plants on aquatic resources and siting principles as they affect aquatic resources are defined. Information-gathering techniques included extensive interviews with key research scientists, state personnel, and numerous Chesapeake Bay watermen.

80-001632 Merna, J. W. INTRODUCTION OF CHLORINATED HYDROCARBONS INTO STREAM FISHES BY SPAWNING SALMON. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1878. 25p. 28 Dec. 1979. SFA 25(2)

[Inst. Fish. Res., Mus. Annex, Ann Arbor, MI 48103] The extent of contamination with chlorinated hydrocarbons of trout resident in two small streams by spawning coho and chinook salmon was determined. An attempt was made to trace PCB, DDT, and dieldrin through the aquatic system following their release from decaying salmon carcasses. No retention of contaminants within the food chain was found. Analysis of stream sediments and crayfish failed to reveal measurable concentrations. However, trout, and to a lesser extent sculpins, accumulated PCB and DDT as a result of eating contaminated salmon eggs. Eggs constituted as much as 87% (by weight) of the total stomach contents of trout collected during the salmon spawning season. The PCB level in salmon eggs ranged from 0.46 to 9.50 ppm, and they were found in trout stomachs from early October to early January. Thus the diet of trout carried a significant level of contamination for a period of at least 90 days. Utilization of eggs was highly variable among individual trout, and there was a strong correlation between numbers of eggs in the stomachs and PCB levels in the fillets. Concentrations of chlorinated hydrocarbons in trout fillets ranged from 0.20 to 4.63 ppm of PCB and 0.11 to 2.52 ppm of DDT. These materials were never detected in samples from the control stream.

80-001633 Miyazaki, T.; K. Akiyama; S. Kaneko; S. Horii and T. Yamagishi. IDENTIFICATION OF CHLORDANES AND RELATED COMPOUNDS IN GOBY-FISH FROM TOKYO BAY. *Bull. Environ. Contam. Toxicol.* 24(1):1-8. Jan. 1980. SFA 25(2)

[Tokyo Metro. Res. Lab. Pub. Health, 24-1, 3-chome, Hyakunincho, Shinjuku-ku, Tokyo, 160 Japan]

80-001634 Moore, L. F. FISHERIES CONSIDERATIONS IN SETTING TEMPERATURE GUIDELINES FOR POWER STATIONS. *Rev. Can. Biol.* 38(4):293-299. Dec. 1979. In English with French summ. SFA 25(2)

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80-001634 CONTINUED
[Ontario Minist. Environ., Water Resour. Br., 135 St. Clair Ave, Toronto, Canada]

80-001635 Murray, L. A. and M. G. Norton. THE COMPOSITION OF DREDGED SPOILS DUMPED AT SEA FROM ENGLAND AND WALES. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 52. 10p. 1979. SFA 25(2)
[Fish. Lab., Burnham-on-Crouch, England]

80-001636 Parris, G. E.; G. W. Diachenko; R. C. Entz; J. A. Poppiti; P. Lombardo; T. K. Rohrer and J. L. Hesse. WATERBORNE METHYLENE *BIS*(2-CHLOROANILINE) AND 2-CHLOROANILINE CONTAMINATION AROUND ADRIAN, MICHIGAN. *Bull. Environ. Contam. Toxicol.* 24(4):497-503. Apr. 1980. SFA 25(2)
[Div. Chem. Technol. (HFF-420), Food Drug Admin., Washington, DC 20204]

80-001637 Phillips, G. R. and D. R. Buhler. MERCURY ACCUMULATION IN AND GROWTH RATE OF RAINBOW TROUT, *SALMO GAIRDNERI*, STOCKED IN AN EASTERN OREGON RESERVOIR. *Arch. Environ. Contam. Toxicol.* 9(1):99-107. 1980. SFA 25(2)
[Coop. Fish. Res. Unit, Mont. State Univ., Bozeman 59717]

80-001638 Platts, W. S.; S. B. Martin and E. R. J. Primbs. WATER QUALITY IN AN IDAHO STREAM DEGRADED BY ACID MINE WATER. *U.S. For. Serv. Intermountain For. Range Exp. Stn. Gen. Tech. Rep.* GTR-INT-67. 1980. SFA 25(2)
[U.S. For. Serv., Intermountain For. Range Exp. Stn., 316 E. Myrtle St., Boise, ID 83706] The loss of a valuable salmonid fish population in the Panther Creek drainage of east-central Idaho led to studies designed to identify the source of toxic materials in the drainage. Numerous studies summarized here indicate that water seepage from adits of the no longer operating Blackbird Mine and leaching from mine waste piles are the principal sources of cobalt, copper, iron, manganese, lead, and zinc in the drainage. Downstream from the mined area, pH values have been lowered to levels lethal to aquatic organisms. High sediment loads in area streams are probably the result of stream scouring below the mined area. Sampling of the drainage yielded no fish nor aquatic insects in areas affected by mining. Upstream from mined areas, diverse populations of both fish and insects existed. Tests showed that trout fingerlings placed downstream from the mined area were killed. Elimination of fish populations from waters altered by mining in the Panther Creek drainage is proably the result of the long-term, chronic effects of heavy metal toxicity. Pollution from the mine, waste dumps, and tailings ponds will remain in the drainage until these areas are rehabilitated.

80-001639 Ramamurthy, V. D. BASELINE STUDY OF THE LEVEL OF CONCENTRATION OF MERCURY IN THE FOOD FISHES OF BAY OF BENGAL, ARABIAN SEA AND INDIAN OCEAN. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1405-1407. Nov. 1979. SFA 25(2)
[Inspection Lab., Mar. Prod. Export Dev. Auth., Wellington Island, Cochin 682 003, India]

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80-001640 Settle, D. M. and C. C. Patterson. LEAD IN ALBACORE: GUIDE TO LEAD POLLUTION IN AMERICANS. *Science* 207(4436):1167-1176. 14 Mar. 1980. SFA 25(2)
[Div. Geol. Planetary Sci., Calif. Inst. Technol., Pasadena 91125]

80-001641 Shapot, R. M. INITIAL POWER PLANT EFFECTS ON FISH DISTRIBUTION IN A SMALL FLORIDA ESTUARY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:529-546. 1978[1979]. SFA 25(2)
[Ecol. Serv., Texas Instruments Inc., P.O. Box 237, Buchanan, NY 10511]

80-001642 Thomas, J. M. and D. H. McKenzie. A PROCEDURE FOR ASSESSING BIOLOGICAL EFFECTS OF POWER PLANTS ON FISH. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):23-27. Nov.-Dec. 1979. SFA 25(2)
[Ecol. Sci. Dep., Battelle Northwest Lab., Richlands, WA]

80-001643 Watanabe, N; Y. Ishimaru; N. Ishida; Y. Katayama and S. Kitayama. [THE USE OF ISAZA (*CHAENOGOBIUS ISAZA* TANAKA) TO STUDY THE PCB POLLUTION.] *Jpn. J. Limnol.* 40(2):66-73. Apr. 1979. In Japanese with English summ. SFA 25(2)
[Kobe Commer. High Sch., Tarumi-ku, Kobe 654, Japan]

80-001644 Westernhagen, H. v.; V. Dethlefsen and H. Rosenthal. CORRELATION BETWEEN CADMIUM CONCENTRATION IN THE WATER AND TISSUE RESIDUE LEVELS IN DAB, *LIMANDA LIMANDA* L., AND PLAICE, *PLEURONECTES PLATESSA* L. *J. Mar. Biol. Assoc. UK* 60(1):45-58. Feb. 1980. SFA 25(2)
[Biol. Anat. Helgoland, Palmaille 9, 2 Hamburg 50, West Germany] Juvenile dab, *Limanda limanda* L., and plaice, *Pleuronectes platessa* L., were kept in cadmium contaminated (5 µg/l, 50 µg/l) flow-through systems for 6 and 96 days. Accumulation of cadmium was measured in backbone, fins, gills, liver, muscle (fillet), otoliths and skin (dorsal and ventral). At both cadmium concentrations there was measurable accumulation after 6 days and significant accumulation in liver and gills after 96 days. At 50 µg/l, except for otoliths, all tissues tested showed significant uptake of cadmium. Growth and condition factors were not affected by either cadmium concentration. At 50 µg/l there was extensive mortality and plaice developed fin erosion.

80-001645 Winner, R. W.; M. W. Boesel and M. P. Farrell. INSECT COMMUNITY STRUCTURE AS AN INDEX OF HEAVY-METAL POLLUTION IN LOTIC ECOSYSTEMS. *Can. J. Fish. Aquatic Sci.* 37(4):647-655. Apr. 1980. SFA 25(2)
[Dep. Zool., Miami Univ., Oxford, OH 45056]

FISH KILLS

80-001646 Bruton, M. N. and R. H. Taylor. CICHLID FISH MORTALITY IN A FRESHWATER LAKE IN NATAL. *Lammergeyer* 27:1-4. Oct. 1979. SFA 25(2)
[Rhodes Univ., South Africa] A mortality of the cichlid fish *Sarotherodon mossambicus* in association with relatively low water temperatures (<13°C) was recorded in a freshwater lake in Natal during June/July 1978. The locality was near the southernmost boundary of natural freshwater populations of *S. mossambicus*, which extends further south in estuaries due to its greater ability to tolerate low temperatures in brackish water.

FISH KILLS

80-001647 Haslouer, S. G. NATURAL AND POLLUTION-CAUSED FISH KILLS IN KANSAS DURING 1978. *Trans. Kans. Acad. Sci.* 82:197-204. 1979. SFA 25(2)

[Div. Environ., Kans. Dep. Health Environ., Topeka 66620] Thirty-four fish kills were reported to the Kansas Department of Health and Environment in 1978. Of these, eleven were determined to have been resultant of natural causes. The remaining twenty-three are either known or suspected to have been caused by man-made pollutants or activities. Where causes were identified, agricultural and industrial oeprations led municipal operations in numbers of pollution-related kills, producing six incidents each. The five fish kills associated with municipal sewage treatment plants and (in one case) water treatment plants accounted for 15 percent of reported 1978 fish kills. The six reports in the unknown (unidentifiable) operations category represented 18 percent of all investigations. In most of these cases intensive investigation was not possible due to late notification of our offices and the transient nature of many pollutants. Agricultural operations killed more fish than any other pollution source in 1978. The 37,827 fish killed by feedlot runoff and other farming activities represent 73 percent of the 51,569 fish killed by pollution last year. The eleven incidents of natural mortalities investigated resulted in the death of 24,955 fish, a full 33 percent of the 76,524 fish which died in the kills reported. The majority of the reports (64 percent) indicate that less than 1000 fish were killed per incident in 1978. Thirty percent of the kills involved 1,000-10,000 fish, and 6 percent (two incidents) involved more than 10,000 fish.

80-001648 Martin, B. B. and D. F. Martin. ROTENONE AS A CAUSATIVE AGENT IN THE MASS MORTALITY OF WHITE AMUR IN AN ORANGE COUNTY, FLORIDA POND. *J. Environ. Sci. Health A Environ. Sci. Eng. (Marcel Dekker, Inc., N.Y.)* 14(8):709-715. 1979. SFA 25(2)

[Dep. Chem., Univ. South Fla., Tampa 33620] Water taken some two days after a mass mortality of white amur in an Orange County, Florida, holding pond was extracted with chloroform. The concentrated extracts were analyzed by high pressure liquid chromatography (HPLC) and were found to contain rotenone, a known fish toxicant, upon comparison with an authentic sample. The water contained, by estimation, 1.8 ppm rotenone. Additional studies were made of the degradation of rotenone and associated materials of commercial samples in lake water in contact with sediment. The carrier materials degrade rapidly, i.e., within two days, though rotenone should persist for purposes of HPLC analysis for two days under ambient environmental conditions. The origin of rotenone in this water is unknown.

TOXICOLOGY; BIOASSAYS

80-001649 Demaël, A.; D. Garin and G. Pérès. RESPONSE OF THE TENCH (*TINCA TINCA* L.) TO POTASSIUM NITRATE ENRICHED WATER. *J. Fish Biol.* 16(1):15-22. Jan. 1980. SFA 25(2)

[Lab. Physiol. Gen. Comp., Univ. Claude Bernard, Lyon I, Villeurbanne, France] When the tench (*Tinca tinca* L.) was exposed to a slight increase, 8.5 mg/l, in the potassium content of the water, metabolic and hormonal changes occurred which lasted more than four weeks. An initial phase of lipolysis was followed by a partial consumption of glycogen reserves, which in turn was followed by a phase of gluconeogenesis. Hyperglycaemia persisted throughout the experiment. The ion distribution in erythrocytes and liver changed relatively early; there was no observable change in water content. These changes are similar to those observed during the osmoregulation of fish.

80-001650 Adeney, R. J. and P. Matthiessen. SUB-LETHAL EFFECTS OF THE ORGANOPHOSPHATE BLACKFLY LARVICIDE, ABATE (TEMEPHOS) ON *SAROTHERODON MOSSAMBICUS* (PETERS). *J. Fish Biol.* 15(5):545-553. Nov. 1979. SFA 25(2)

TOXICOLOGY; BIOASSAYS

80-001650 CONTINUED
[Cent. Overseas Pest Res., Overseas Dev. Admin., Coll. House, Wrights Lane, London W8 5SJ, England] *Sarotherodon mossambicus* was exposed for up to 10 weeks to concentrations of Abate larvicide in excess of those produced during blackfly control in African rivers. Despite this treatment, several indicators of sub-lethal poisoning, e.g. growth, plasma glucose, acetylcholinesterase activity remained almost unchanged. A possible explanation for the low toxicity of Abate is given.

80-001651 Alabaster, J. S.; D. G. Shurben and G. Knowles. THE EFFECT OF DISSOLVED OXYGEN AND SALINITY ON THE TOXICITY OF AMMONIA TO SMOLTS OF SALMON, *SALMO SALAR* L. *J. Fish Biol.* 15(6):705-712. Dec. 1979. SFA 25(2)
[Water Res. Cent., Stevenage Lab., Elder Way, Stevenage, Herts. SG1 1TH, England]

80-001652 Anderson, A. D.; M. E. Lebsack; G. M. DeGraeve; D. S. Farrier and H. L. Bergman. TOXICITY OF AN *IN SITU* OIL SHALE PROCESS WATER TO RAINBOW TROUT AND FATHEAD MINNOWS. *Arch. Environ. Contam. Toxicol.* 9(2):171-179. 1980. SFA 25(2)
[Sch. Pharm., Univ. Wyo., Box 3375, University Station, Laramie 82071]

80-001653 Andros, J. D. and R. R. Garton. ACUTE LETHALITY OF COPPER, CADMIUM, AND ZINC TO NORTHERN SQUAWFISH. *Trans. Am. Fish. Soc.* 109(2):235-238. Mar. 1980. SFA 25(2)
[U.S. EPA, West. Fish Toxicol. Stn., Corvallis, OR 97330]

80-001654 Bolis, L. and J. C. Rankin. INTERACTIONS BETWEEN VASCULAR ACTIONS OF DETERGENT AND CATECHOLAMINES IN PERFUSED GILLS OF EUROPEAN EEL, *ANGUILLA ANGUILLA* L. AND BROWN TROUT, *SALMO TRUTTA* L. *J. Fish Biol.* 16(1):61-73. Jan. 1980. SFA 25(2)
[Dep. Physiol., Univ. Messina, 5 Via del Vespro, Messina, Italy] Noradrenaline induced vasodilation in isolated perfused eel or trout gills was inhibited by propranolol, a β-adrenergic blocking agent. The noradrenaline effect was much reduced in gills of fish which had been kept in 1 mg/l solutions of the detergent LAS (linear alkylate sulphonate; 12C chain length). LAS produced concentration-dependent vasodilation, which was inhibited by propranolol, in eel and trout gills. Noradrenaline produced additional vasodilation in eel and trout gills which had been dilated by $2 \cdot 1/10^{8}$M LAS but had no effect on trout gills perfused with $2 \cdot 1/10^{7}$M LAS. Gills from trout which had been kept in 0.1 mg/l LAS responded to noradrenaline normally but the propranolol inhibition appeared to be potentiated.

80-001655 Borgmann, U.; R. Cove and C. Loveridge. EFFECT OF METALS ON THE BIOMASS PRODUCTION KINETICS OF FRESHWATER COPEPODS. *Can. J. Fish. Aquatic Sci.* 37(4):567-575. Apr. 1980. SFA 25(2)
[Great Lakes Biolimnol. Lab., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

80-001656 Brenniman, G. R.; M. R. Anver; R. Hartung and S. H. Rosenberg. EFFECTS OF OUTBOARD MOTOR EXHAUST EMISSIONS ON GOLDFISH (*CARASSIUS AURATUS*). *J. Environ. Pathol. Toxicol.* 2(6):1267-1281. July-Aug. 1979.

TOXICOLOGY; BIOASSAYS

80-001656 CONTINUED SFA 25(2)
[Environ. Health Sci., Sch. Pub. Health, Univ. Ill. Med. Cent., Chicago 60680] Goldfish (*Carassius auratus*) were exposed to outboard exhaust products in water or to toluene (a constituent of outboard motor exhaust water) via a continuous flow bioassay dosing apparatus. Various physiologic and pathologic changes were noted. In the blood a consistent decrease ($p<0.05$) in the partial pressure of oxygen, a significant increase ($p<0.05$) in the partial pressures of carbon dioxide, and significant decreases ($p<0.05$) in pH and oxygen saturation were found in many of the blood gas experiments. Laboratory experiments also indicated that these fish are capable of metabolizing toluene to hippuric acid ($p<0.05$). Exposure up to 30 days to these exhaust products produced gross and microscopic lesions in the high-, intermediate-, and low-dose fish. Grossly, livers were smaller and pale; intestines were empty of ingesta and feces; and gills were coated excessively with mucus. Microscopically, the livers of the exposed fish had a decreased cytoplasmic:nuclear ratio, gill filaments were fused, and some kidneys had tubular vacuolization.

80-001657 Califano, R. J.; J. M. O'Connor and L. S. Peters. UPTAKE, RETENTION, AND ELIMINATION OF PCB (AROCLOR 1254) BY LARVAL STRIPED BASS (*MORONE SAXATILIS*). *Bull. Environ. Contam. Toxicol.* 24(3):467-472. Mar. 1980. SFA 25(2)
[N.Y. Univ. Med. Cent., Inst. Environ. Med., A. J. Lanza Lab., Tuxedo 10987]

80-001658 Cameron, J. A. and R. L. Smith. ULTRASTRUCTURAL EFFECTS OF CRUDE OIL ON EARLY LIFE STAGES OF PACIFIC HERRING. *Trans. Am. Fish. Soc.* 109(2):224-228. Mar. 1980. SFA 25(2)
[Inst. Mar. Sci., Univ. Alaska, Fairbanks 99701]

80-001659 Colwell, A. E. and C. H. Schaefer. DIETS OF *ICTALURUS NEBULOSUS* AND *POMOXIS NIGROMACULATUS* ALTERED BY DIFLUBENZURON. *Can. J. Fish. Aquatic Sci.* 37(4):632-639. Apr. 1980. SFA 25(2)
[Lake County Mosquito Abatement Dist., Lakeport, CA 95453]

80-001660 Couch, J. A.; J. T. Winstead; D. J. Hansen and L. R. Goodman. VERTEBRAL DYSPLASIA IN YOUNG FISH EXPOSED TO THE HERBICIDE TRIFLURALIN. *J. Fish. Dis.* 2(1):35-42. Jan. 1979. SFA 25(2)
[U.S. EPA, Gulf Breeze Environ. Res. Lab., Gulf Breeze, FL 32561] Sheepshead minnows, *Cyprinodon variegatus* Lacépède, exposed to 5.5 to 31 µg/l of the herbicide trifluralin, throughout their first 28 days of life, developed a heretofore undescribed vertebral dysplasia. This dysplasia consisted of semi-symmetrical hypertrophy of vertebrae (three to 20 times normal), characterized by foci of osteoblast and fibroblasts actively laying down bone and bone precursors. Effects of the abnormal vertebral development were dorsal vertebral growth into the neural canal, ventral compression of renal ducts, and longitudinal fusion of vertebrae. Fish, exposed for 51 days to 16.6 µg/l trifluralin and thereafter depurated for 41 days, showed no increase in vertebral dysplasia during dupuration; however, residual spinal column damage was evident. Serum calcium concentrations were elevated in adult fish exposed for 4 days to 16.6 µg/l trifluralin. Fluorosis or mimicry of hypervitaminosis A are considered possible mechanisms for the osseous effect, but are not considered to be the only possible causes. The highly predictable nature of this disorder in experimental exposures strengthens the probability that young fish may serve as experimental models for determining effects of chemicals on early vertebrate ontogeny, particularly in regard to skeletal development.

TOXICOLOGY; BIOASSAYS

80-001661 Das, K. K.; S. G. Dastidae; S. Chakrabarty and S. K. Banerjee. TOXICITY OF MERCURY: A COMPARATIVE STUDY IN AIR-BREATHING AND NON AIR-BREATHING FISH. *Hydrobiologia* 68(3):225-229. 16 Feb. 1980. SFA 25(2)
[Dep. Biochem., Univ. Coll. Sci. Calcutta 700 019, India] In a mercury polluted environment, air-breathing fishes are more resistant towards mercury toxicity than the non air-breathing fishes as regards their duration of survival and growth. Under sub-acute levels of mercury exposure, they respond differently in so far as the activities of their liver, gill and intestinal lysosomal enzymes and liver microsomal enzymes are concerned. Alteration in the levels of liver microsomal glucose-6-phosphatase, serum glucose and liver glycogen indicate that carbohydrate metabolism is impaired under the above experimental condition.

80-001662 Daye, P. G. and E. T. Garside. STRUCTURAL ALTERATIONS IN EMBRYOS AND ALEVINS OF THE ATLANTIC SALMON, *SALMO SALAR* L., INDUCED BY CONTINUOUS OR SHORT-TERM EXPOSURE TO ACIDIC LEVELS OF pH. *Can. J. Zool.* 58(1):27-43. Jan. 1980. In English with French summ. SFA 25(2)
[Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Embryos of the Atlantic salmon, *Salmo salar* L., were incubated continuously from fertilization, at pH 6.8 (control), 5.0, 4.5, 4.3, 4.0, and 3.7, at 5-6°C. The subsequent alevins in these environments were maintained at these levels for 40 days after hatching. Generally, lethal and sublethal injuries were separable only as to degree and distribution. Sublethal alterations occurred in the integument, gill, blood, and blood vascular structures of all live alevins incubated at pH 5.0 and lower. At pH 4.5 and lower, injuries also occurred in brain, optic retina, kidney, and spleen. Some tissue regeneration occurred in the embryonal rudimentary integument at pH 4.5 and lower. Regeneration also occurred but to a lesser degree in pseudobranch, kidney, spleen, and erythrocytes. Injury of the integument was the apparent cause of death in prehatching embryos since it is the major site of respiration and ion exchange. As gills expand in posthatching alevins, they assume these functions and destruction of branchial epithelium then becomes the prime cause of death. The nature of cell injury and consequent dysgenesis at tissue and organ levels are not ascribable uniquely to acidic stress. Some injuries are similar to those caused variously by heavy metals, detergents, halogenated organic compounds, some petroleum fractions, and chronic and acute high temperature in postalevin stages of several species of fish.

80-001663 Dean, H. J.; J. C. Skea; J. R. Colquhoun and H. A. Simonin. REPRODUCTION OF LAKE TROUT IN LAKE GEORGE. *N.Y. Fish Game J.* 26(2):188-191. July 1979. SFA 25(2)
[State Fish Hatchery, Rome, NY 13440]

80-001664 Dodson, J. J. and C. I. Mayfield. THE DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN® (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT. *Trans. Am. Fish. Soc.* 108(6):632-640. Nov. 1979. SFA 25(2)
[Dep. Biol., Univ. Laval, PQ G1K 7P4, Canada]

80-001665 Eurell, J. A. C. THE EFFECTS OF EXPOSURE TO WATER SOLUBLE FRACTIONS OF CRUDE OIL ON THE HISTOLOGY AND SELECTED HISTOCHEMICAL PARAMETERS OF THE LIVER OF ATLANTIC CROAKER (*MICROPOGON UNDULATUS* L.). *Ph.D.*

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80-001665 CONTINUED *dissertation, Texas A&M Univ.* 147p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3610. Feb. 1980. SFA 25(2)

80-001666 Gilbert, J. P.; J. B. Gratzek and J. Brown. AN *IN VITRO* METHOD FOR TESTING SYNERGISTIC ACTION OF PARASITICIDES USING MALACHITE GREEN AND FORMALIN AS A MODEL SYSTEM. *J. Fish Dis.* 2(3):191-196. May 1979. SFA 25(2)
[Dep. Med. Microbiol., Coll. Vet. Med., Univ. Ga., Athens 30602]

80-001667 Haider, G. HISTOPATHOLOGISCHE VERÄNDERUNGEN AM SEITENLINIENSYSTEM DER REGENBOGENFORELLE (*SALMO GAIRDNERI* RICH.) NACH SUBLETALER SCHWERMETALLVERGIFTUNG. [HISTOPHATOLOGICAL EFFECTS OF SUBLETHAL POISONING BY HEAVY METALS UPON THE LATERAL LINE SYSTEM IN RAINBOW TROUT (*SALMO GAIRDNERI* RICH.)] *Zool. Anz.* 203(5/6):378-391. 1979. In German with English summ. SFA 25(2)
[Univ. Stuttgart, West Germany]

80-001668 Halter, M. T.; W. J. Adams and H. E. Johnson. SELENIUM TOXICITY TO *DAPHNIA MAGNA, HYALLELA AZTECA,* AND THE FATHEAD MINNOW IN HARD WATER. *Bull. Environ. Contam. Toxicol.* 24(1):102-107. Jan. 1980. SFA 25(2)
[Coll. Fish., Univ. Wash., Seattle 98115]

80-001669 Hedtke, J. L. and L. A. Norris. EFFECT OF AMMONIUM CHLORIDE ON PREDATORY CONSUMPTION RATES OF BROOK TROUT (*SALVELINUS FONTINLIS*) ON JUVENILE CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) IN LABORATORY STREAMS. *Bull. Environ. Contam. Toxicol.* 24(1):81-89. Jan. 1980. SFA 25(2)
[L. A. Norris: For. Sci. Lab., 3200 Jefferson Way, Corvallis, OR 97331]

80-001670 Helfrich, L. A. EFFECTS OF ROTENONE ON MACROBENTHIC INVERTEBRATES OF A PENNSYLVANIA STREAM. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:401-408. 1978[1979]. SFA 25(2)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] Although the use of rotenone as a fish toxicant is a common freshwater fisheries management technique, little is known of its effect on stream invertebrates. In this study pre- and post-treatment bottom samples of benthic invertebrates, collected from 4 study stations, were compared to determine the short-term effects of rotenone. Continuous drift samples collected throughout the treatment period provided additional qualitative information on the vulnerability of the benthic invertebrates to the toxin. Of the 4 major orders of macrobenthic invertebrates represented in Sinking Creek (Trichoptera, Ephemeroptera, Plecoptera, and Diptera), all exhibited substantial decreases in numerical abundance 11 days after rotenone treatment. Populations of Plecoptera (stoneflies) and Diptera (blackflies and midge larvae) were nearly exterminated, while densities of the 2 remaining taxa, Trichoptera (caddisflies) and Ephemeroptera (mayflies) were reduced to 50% of the pretreatment levels. All 4 orders appeared in increased numbers in the drift samples taken during the treatment period.

80-001671 Hemmer, M. J. A PRESSURIZED PROPORTIONAL DILUTER FOR AQUATIC TOXICOLOGICAL STUDIES. *Water Res.* 14(3):243-246. 1980. SFA 25(2)
[U.S. EPA, Gulf Breeze Environ. Res. Lab., Sabine Island, FL 32561] A

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80-001671 CONTINUED half-liter proportional diluter using positive pressure was designed and tested. Its primary siphons are activated by a pulse of pressure instead of by a partial vacuum as in conventional diluters. This method eliminates the need for venturi tubes, vacuum manifolds, and individual water blocks. Pressure can be supplied by air pumps, air cylinders, or air compressor lines. The diluter's advantages are ease of construction, calibration, compact size, and rapid cleaning. Unit cost is approximately $250.00.

80-001672 Hendricks, J. D.; R. O. Sinnhuber; P. M. Loveland; N. E. Pawlowski and J. E. Nixon. HEPATOCARCINOGENICITY OF GLANDLESS COTTONSEEDS AND COTTONSEED OIL TO RAINBOW TROUT *(SALMO GAIRDNERI)*. *Science* 208(4441):309-311. 18 Apr. 1980. SFA 25(2)

[Dep. Food Sci. Technol., Oreg. State Univ., Corvallis 97331] Glandless cottonseed kernels are available for purchase and consumption by the general public. These kernels contain no gossypol but still have a full complement of naturally occurring cyclopropenoid fatty acids, which in rainbow trout are active as synergists with aflatoxins and primary liver carcinogens. Diets containing glandless cottonseed kernels or a lightly processed cottonseed oil produced significant numbers of hepatocellular carcinomas in rainbow trout after 1 year. The much greater incidence of cancer induced by the kernel than by the oil indicates that synergists or other carcinogens may be present in the kernel in addition to the cyclopropenoid fatty acids.

80-001673 Hill, M. W.; J. Hoyland and A. D. Bangham. EFFECTS OF TEMPERATURE AND N-BUTANOL (A MODEL ANAESTHETIC) ON A BEHAIVOURAL FUNCTION OF GOLDFISH. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 135(4):327-332. Feb. 1980. SFA 25(2)

[Biophys. Unit, A.R.C., Inst. Anim. Physiol., Babraham, Cambridge CB2 4AT, England]

80-001674 Hinton, M. J. and A. G. Eversole. TOXICITY OF TEN COMMONLY USED CHEMICALS TO AMERICAN EELS. *Proc. Annu. Conf. Southeast. Assoc. Fish. Wildl. Agencies* 32:599-604. 1978[1979]. SFA 25(2)

[Dep. Entomol. Econ. Zool., Clemson Univ., Clemson, SC 29631] Malachite green, potassium permanganate, salt, formalin, Dylox, Furanace, antimycin A, Noxfish, copper sulfate, and Diquat were tested to determine 96-hour LC_{50} values for the glass eel stage of the American eel, *Anguilla rostrata* (Lesueur). Static acute toxicity tests were conducted at 22 C using deionized water reconstituted to a hardness of 40-48 mg/l, an alkalinity of 30-35 mg/l and a pH of 7.2-7.6. The calculated 96-hour LC_{50} values for the chemicals are: malachite green 0.27 mg/l; potassium permanganate 3.06 mg/l; salt 17.88 g/l; formalin 83.96 mg/l; Dylox 1.31 mg/l; Furanace 0.77 mg/l; antimycin A 0.09 µg/l; Noxfish 15.25 µg/l; copper sulfate 2.54 mg/l; and Diquat 39.02 mg/l.

80-001675 Hoke, R. A. and B. L. Prater. THE RELATIONSHIP OF % MORTALITY OF FOUR SPECIES OF AQUATIC BIOTA FROM 96-HOUR SEDIMENT BIOASSAYS OF FIVE LAKE MICHIGAN HARBORS AND ELUTRIATE CHEMISTRY OF THE SEDIMENTS. *Ohio J. Sci.* 80:95. 1980. Abstract only. SFA 25(2)

[Dep. Biol. Sci., Bowling Green State Univ., Bowling Green, OH 43403] During the summer and fall of 1977, sediment grab samples were collected from forty stations in five Lake Michigan harbors using a Standard Ponar dredge. Samples were split and a portion used as the substrate for 96-hour sediment bioassays using *Pimephales promelas, Hexagenia limbata, Lirceus*

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80-001675 CONTINUED *fontinalis*, and *Daphnia magna*. The remaining portion of each sample was analyzed for fifteen elutriate chemistry parameters. Elutriate chemistry data and % mortality data of the four test species were bivariately correlated. Of the sixty total correlations performed, four were significant (N=40, $r \geq 0.40$, $p \leq 0.05$). Release of chloride correlated with % mortality of *P. promelas* (r=0.59) and *H. limbata* (r=0.40). Percent mortality of *H. limbata* also correlated with release of ammonia (r=0.44) and nickel (r=0.72) during the elutriate test. The relationship of chloride release and % mortality of *P. promelas* may indicate a threshold effect occurs at 41 mg/l release of chloride. Ammonia and nickel have been previously reported as toxic to aquatic biota. The present investigation indicates that a linear relationship accounts for ≥ 50% of the variance in the relationship between nickel release from the sediments and % mortality of *H. limbata*.

80-001676 Holman, W. F. and K. J. Macek. AN AQUATIC SAFETY ASSESSMENT OF LINEAR ALKYLBENZENE SULFONATE (LAS): CHRONIC EFFECTS ON FATHEAD MINNOWS. *Trans. Am. Fish. Soc.* 109(1):122-131. Jan. 1980. SFA 25(2)
[Environ. Safety Dep., Proctor & Gamble Co., Ivorydale Tech. Cent., Cincinnati, OH 45217]

80-001677 Ilan, Z. and Z. Yaron. EFFECTS OF ORGANOCHLORINES ON INTERRENAL ACTIVITY AND CORTISOL METABOLISM IN *TILAPIA AUREA*. *Gen. Comp. Endocrinol.* 40(3):345. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Tel Aviv Univ., Tel Aviv, Israel]

80-001678 Karpovich, T. A. and B. I. Kolupayev. AN ELECTROMYOGRAM OF THE MANDIBULAR ADDUCTOR OF THE INTACT BAIKAL GRAYLING, *THYMALLUS ARCTICUS BAICALENSIS*, IN A PHENOL SOLUTION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):866-869. 1978. SFA 25(2)
[Dep. Ecol. Toxicol., All-Union Cellulose Paper Ind. Sci. Prod. Combine, Baikal'sk, USSR]

80-001679 Kiceniuk, J. W.; G. L. Fletcher and R. Misra. PHYSIOLOGICAL AND MORPHOLOGICAL CHANGES IN A COLD TORPID MARINE FISH UPON ACUTE EXPOSURE TO PETROLEUM. *Bull. Environ. Contam. Toxicol.* 24(2):313-319. Feb. 1980. SFA 25(2)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-001680 Kobayashi, K. and N. Nakamura. MAJOR DETOXIFICAITON PATHWAYS FOR PENTACHLOROPHENOL IN GOLDFISH. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1185-1188. Sept. 1979. SFA 25(2)
[Lab. Fish. Chem., Fac. Agric., Kyushu Univ., Fukuoka 812, Japan]

80-001681 Koundinya, P. R. and R. Ramamurthi. EFFECT OF ORGANOPHOSPHATE PESTICIDE SUMITHION (FENITROTHION) ON SOME ASPECTS OF CARBOHYDRATE METABOLISM IN A FRESHWATER FISH, *SAROTHERODON (TILAPIA) MOSSAMBICUS* (PETERS). *Experientia (Basel)* 35(12):1632-1633. Dec. 1979. SFA 25(2)
[Dep. Zool., Sri Venkateswara Univ. Coll., Tirupati, India] A lethal (LC_{50}/48 h - 6 mg/l) concentration of the organophosphate (OP)

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80-001681 CONTINUED pesticide Sumithion increased blood glucose levels and phosphorylase activity, but hepatic glycogen registered a fall which indicated that the observed hyperglycemia was due to breakdown of hepatic glycogen.

80-001682 Kumada, H.; S. Kimura and M. Yokote. ACCUMULATION AND BIOLOGICAL EFFECTS OF CADMIUM IN RAINBOW TROUT. *Bull. Jpn. Soc. Sci. Fish.* 46(1):97-103. Jan. 1980. SFA 25(2)

[Arasaki Mar. Biol. Stn., Nagai, Yokosuka-shi, Kanagawa-ken 238-03, Japan] Biological effects and accumulation of cadmium stearate, acetate, and chloride in rainbow trout fingerlings were investigated. No adverse effect was observed on survival, growth and histology of the fish exposed to cadmium compounds via water at a concentration of 4 µgCd/l for 10 weeks, and also the fish exposed to the same compounds via food at a concentration of 10 mgCd/kg for 12 weeks. However, the fish orally exposed to cadmium stearate of 100 mgCd/kg showed histological changes of a slight degree in their livers and kidneys. Total cadmium loads (µgCd/fish) prominently decreased in the fish orally exposed to the chemicals 10 weeks after discontinuation of exposure, while those in the exposed fish via ambient water almost remained unchanged during this time. Translocation of cadmium in the tissue showed different pattern with route of absorption after withdrawal of exposure. From the results of the present study, it is postulated that the route of cadmium absorption via water chiefly may participate in the accumulation of the metal in fishes under the natural condition.

80-001683 Leatherland, J. F. and R. A. Sonstegard. EFFECT OF DIETARY MIREX AND PCB (AROCLOR 1254) ON THYROID ACTIVITY AND LIPID RESERVES IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish. Dis.* 2(1):43-48. Jan. 1979. SFA 25(2)

[Dep. Zool., Univ. Guelph, Guelph, ON, Canada] Rainbow trout were fed diets contaminated with either PCB (Aroclor 1254, 500 µg/g dry food) or Mirex (500 µg/g dry food). There was no apparent effect of PCB on thyroid histology or on serum thyroid hormone levels. Mirex effected significant reductions in serum T_4 ($P<0.05$) and T_3 levels ($P<0.01$) without apparent change in the histological appearance of the thyroid. Liver weights and total liver lipid content were significantly ($P<0.001$) greater in PCB-fed fish compared with controls as was the carcass lipid content ($P<0.01$). Mirex had no apparent effect on liver size or liver lipid content but there was a decline in carcass lipid content ($P<0.02$) which persisted 25 days after returning Mirex-fed fish to the control diet ($P<0.05$).

80-001684 Lehtinen, K-J. EFFECTS ON FISH EXPOSED TO EFFLUENT FROM A TITANIUM DIOXIDE INDUSTRY AND TESTED WITH ROTATORY-FLOW TECHNIQUE. *Ambio* 9(1):31-33. 1980. SFA 25(2)

[Swedish Water Air Pollut. Res. Inst., S-611 82 Nyköping, Sweden]

80-001685 Miyauchi, M.; M. Takagi and T. Uematsu. STUDIES ON TOXICITIES OF BIPHENYL ETHER HERBICIDES AND THEIR ANALOGUES TO FISH--I. THE METHEMOGLOBIN-FORMATION BY THE NITROSO-DERIVATIVES IN WHITE-SPOTTED CHAR, *SALVELINUS LEUCONAENIS* ERYTHROCYTES. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1563-1567. Dec. 1979. SFA 25(2)

[Lab. Food Hygiene, Fac. Fish., Hokkaido Univ., Hakodate 041, Japan] The methemoglobin formation by the nitroso-derivatives of biphenyl ether herbicides (2,4-dichloro *p*-nitrobiphenyl ether and 2,4,6-trichloro *p*-nitrobiphenyl ether) and their analogues was investigated in

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80-001685 CONTINUED suspensions of white-spotted char erythrocytes. All of the nitroso-derivatives used, induced the methemoglobin formation in white-spotted char erythrocytes as well as human erythrocytes and the activity of methemoglobin formation among the nitroso-derivatives was the most potent in nitrosobenzene followed by *p*-nitrosobiphenyl ether, 4-chloro *p*-nitrosobiphenyl ether, 2,4-dichloro *p*-nitrosobiphenyl ether and then 2,4,6-trichloro *p*-nitrosobiphenyl either in erythrocytes in both species. This order among the nitroso-derivatives was dependent on the number of chlorine rather than on its position of substitution in the phenoxy group.The mechanism of methemoglobin formation by the nitroso-derivatives was similar in erythrocytes of both species and on the requirement of NADPH-dependent enzyme systems, and that of methemoglobin reduction was similar, too, on reception of NADH-dependent enzymatic process.

80-001686 Miyauchi, M.; M. Takagi and T. Uematsu. STUDIES ON TOXICITIES OF BIPHENYL ETHER HERBICIDES AND THEIR ANALOGUES TO FISH--II. PRODUCTION OF METHEMOGLOBIN-FORMING METABOLITES OF THE AMINO-DERIVATIVES BY WHITE-SPOTTED CHAR, *SALVELINUS LEUCOMAENIS*, LIVER HOMOGENATE. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1569-1573. Dec. 1979. SFA 25(2)

[Lab. Food Hygiene, Fac. Fish., Hokkaido Univ., Hakodate 041, Japan] The activities of liver homogenates from white-spotted char and rat, to metabolize the amino-derivatives of biphenyl ether herbicides (2,4-dichloro *p*-nitrobiphenyl ether and 2,4,6-trichloro *p*-nitrobiphenyl ether) and their analogues to methemoglobin-forming metabolites were compared by incubating liver homogenates with the amino-derivatives, a NADPH-generating system and white-spotted char, rat or human erythrocytes. The results indicated that white-spotted char liver homogenates had the ability to metabolize *p*-aminobiphenyl ether to methemoglobin-forming metabolites although the activity was very low; white rat liver homogenates had the ability to metabolize all the amino-derivatives to methemoglobin-forming metabolites and the rates of methemoglobin formation among the amino-derivatives were the highest in *p*-aminobiphenyl ether followed by 4-chloro *p*-aminobiphenyl ether, 2,4-dichloro *p*-aminobiphenyl ether and then 2,4,6-trichloro *p*-aminobiphenyl ether. The sensitivity of erythrocytes to the methemoglobin-forming metabolites were the highest in human followed by rat and then white-spotted char erythrocytes.

80-001687 Muntyan, S. P. SOME OBSERVATIONS ON THE REPRODUCTION AND EMBRYONIC DEVELOPMENT OF FIVE SPECIES OF FISH KEPT IN EXPERIMENTAL RADIACTIVE WATER BODIES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1033-1038. 1978. SFA 25(2)

[IEMEZh, USSR Acad. Sci., Moscow, USSR] The experiments show a very high rate of survival of eggs taken from the spawning grounds of the perch and roach inhabiting a body of water with increased radioactivity. The slightly lower rate of survival of the eggs of the pike and of the crucian carp and common wild goldfish obtained by artificial fertilization is evidently above all connected with the imperfection of the method of obtaining the eggs from these fish and the unfavorable influence of the incubation temperature and gas regimes. Nonetheless, for these fish too the number of normal embryos at the end of incubation is considerable. The results of the experiments are similar to those of the incubation of eggs of the species mentioned without the action of the radioactive factor; they show that the maturation of sexual products, spawning and normal development of the embryos of these species under the conditions of the current levels of radioactivity is practicable. This conclusion is also confirmed by the fact that in the bodies of water investigated there have been several generations of fish since the time that radionuclides were introduced into them.--From text.

TOXICOLOGY; BIOASSAYS

80-001688 Nagel, R. and K. Urich. KINETIC STUDIES ON THE ELIMINATION OF DIFFERENT SUBSTITUTED PHENOLS BY GOLDFISH (*CARASSIUS AURATUS*). *Bull. Environ. Contam. Toxicol.* 24(3):374-378. Mar. 1980. SFA 25(2)
[Dep. Zool., Johannes-Gutenberg-Univ., Mainz, Saarstrasse 21, D-6500 Mainz, West Germany]

80-001689 Neville, C. M. INFLUENCE OF MILD HYPERCAPNIA ON THE EFFECTS OF ENVIRONMENTAL ACIDIFICATION ON RAINBOW TROUT (*SALMO GAIRDNERI*). *J. Exp. Biol.* 83:345-349. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Toronto, Toronto, ON, Canada]

80-001690 Ozoh, P. T. E. EFFECTS OF REVERSIBLE INCUBATIONS OF ZEBRAFISH EGGS IN COPPER AND LEAD IONS WITH OR WITHOUT SHELL MEMBRANES. *Bull. Environ. Contam. Toxicol.* 24(2):270-275. Feb. 1980. SFA 25(2)
[P.O. Box 3418, Onitscha, Anambra State, Nigeria]

80-001691 Ozoh, P. T. E. EFFECT OF LEAD ON PIGMENT PATTERN FORMATION IN ZEBRAFISH (*BRACHYDANIO RERIO*). *Bull. Environ. Contam. Toxicol.* 24(2):276-282. Feb. 1980. SFA 25(2)
[P.O. Box 3418, Onitscha, Anambra State, Nigeria]

80-001692 Passino, D. R. M. and J. M. Kramer. TOXICITY OF ARSENIC AND PCBs TO FRY OF DEEPWATER CISCOES (*COREGONUS*). *Bull. Environ. Contam. Toxicol.* 24(4):527-534. Apr. 1980. SFA 25(2)
[U.S. FWS, Great Lakes Fish. Lab., Ann Arbor, MI 48105]

80-001693 Pechkurenkov, V. L. and G. L. Pokrovskaya. ON THE CORRESPONDENCE OF DATA ON THE INCUBATION OF FISH EGGS IN SOLUTIONS OF STRONTIUM-90 -- YTTRIUM-90 OF VARYING ACTIVITY UNDER LABORATORY CONDITIONS AND IN NATURAL WATERS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):995-1004. 1978. SFA 25(2)
[All-Union Res. Inst. Pond Fish., USSR Acad. Sci., USSR]

80-001694 Pfeifer, K. F. and L. J. Weber. THE EFFECT OF CARBON TETRACHLORIDE TREATMENT ON URINE FLOW RATE OF THE RAINBOW TROUT, *SALMO GAIRDNERI*. *Toxicol. Appl. Pharmacol.* 52(2):347-350. Feb. 1980. SFA 25(2)
[Allied Chemical Corp., Morristown, NJ 07960]

80-001695 Pittinger, C. A. and D. S. Tennant. CRITICAL SURFACE TENSION OF SODIUM LAURAL SULFATE TO THE FATHEAD MINNOW, *PIMEPHALES PROMELAS*. *J. Tenn. Acad. Sci.* 55(2):54. Apr. 1980. Abstract only. SFA 25(2)

80-001696 Redner, B. D.; J. R. Tomasso and B. A. Simco. SHORT TERM ALLEVIATION OF AMMONIA TOXICITY BY ENVIRONMENTAL SODIUM CHLORIDE IN CHANNEL CATFISH (*ICTALURUS PUNCTATUS*). *J. Tenn. Acad. Sci.* 55(2):54. Apr. 1980. Abstract only. SFA 25(2)
[Memphis State Univ., Memphis, TN] Plasma sodium depletion has been suggested as a contributing mechanism of ammonia toxicity in aquatic animals. The addition of sodium chloride to water has long been recognized as a method for preventing plasma electrolyte depletion in fish. This study was designed to determine the effect of environmental sodium chloride on ammonia toxicity to channel catfish (*Ictalurus punctatus*). The 6, 12 and 24 hour median lethal concentrations (LC50) of total ammonia nitrogen in fresh water (pH=6.9-7.1, total hardness=47 mg/liter, temperature=20-24°C) were

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80-001696 CONTINUED significantly lower (305.5±21.9, 255.2±10.3, 269.9±9.2 mg/liter ±S.E., respectively) than in isonatremic (8.3 g/liter NaCl) water (832.9±16.5, 367.7±16.8, 337.7±13.2 mg/liter ±S.E., respectively). However, the 48 hour LC50 values were not different (287.7±5.9 versus 256.9±3.4 mg/liter), indicating that environmental sodium chloride has only a short term protective effect. This effect is probably due to prevention of plasma sodium depletion. The absence of a long term protective effect by sodium chloride indicates the presence of other mechanisms of ammonia toxicity.

80-001697 Sastry, K. V. and P. K. Gupta. CHANGES IN THE ACTIVITIES OF SOME DIGESTIVE ENZYMES OF *CHANNA PUNCTATUS*, EXPOSED CHRONICALLY TO MERCURIC CHLORIDE. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes (Marcel Dekker, Inc., N.Y.)* 15(1):109-119. 1980. SFA 25(2)
[Sch. Environ. Contam. Toxicol., Dep. Zool., D. A. V. (P.G.) Coll., Muzaffarnagar, India]

80-001698 Sastry, K. V. and K. Sharma. DIAZINON EFFECT ON THE ACTIVITIES OF BRAIN ENZYMES FROM *OPHIOCEPHALUS (CHANNA) PUNCTATUS*. *Bull. Environ. Contam. Toxicol.* 24(3):326-332. Mar. 1980. SFA 25(2)
[Sch. Environ. Contam. Toxicol., Dep. Zool., D.A.V. (P.G.) Coll., Muzaffarnagar, India]

80-001699 Schubauer, J. P.; C. L. Scott; K. T. Kowalski and J. R. Spotila. EFFECT OF TETRACYCLINE HYDROCHLORIDE TREATMENT ON THE CRITICAL THERMAL MAXIMUM OF COMMON SHINERS. *Prog. Fish-Cult.* 42(1):48-49. Jan. 1980. SFA 25(2)
[Savannah River Ecol. Lab., Drawer E, Aiken, SC 29801]

80-001700 Skadsen, J. M.; P. W. Webb and P. T. Kostecki. MEASUREMENT OF SUBLETHAL METABOLIC STRESS IN RAINBOW TROUT (*SALMO GAIRDNERI*) USING AUTOMATED RESPIROMETRY. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes (Marcel Dekker, Inc., N.Y.)* 15(2):193-206. 1980. SFA 25(2)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Sublethal effects of rotenone on the metabolic rates of rainbow trout (*Salmo gairdneri* Richardson) were determined. Metabolic measurements were made by the method of increasing velocity steps, using a miniature version of the Blazka respirometer with automatic dissolved oxygen measurement. Regressions of log metabolic rate versus swimming speed (expressed as relative performance) were compared for the toxicant levels tested. Results were interpreted in terms of Fry's classification of environmental factors using metabolic response categories ("Fry's paradigm"). At high rotenone dosages (96 hr. LC 50), reduction in the critical swimming speed and the active metabolic rate (limiting effect) were observed. At lower toxicant levels (0.20 x 96 hr. LC 50) the standard metabolic rate was elevated (masking effect) and the limiting effect disappeared. The elevation in metabolic rate decreased in competition with locomotor energy costs as they increased with swimming speed (modulated masking effect).

80-001701 Smit, G. L.; J. Hattingh and A. P. Burger. HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS 222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: INTRASPECIES DIFFERENCES.

TOXICOLOGY; BIOASSAYS

80-001701 CONTINUED *J. Fish Biol.* 15(6):645-653. Dec. 1979. SFA 25(2)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa] The effects of different concentrations of natural MS 222 and neutralized MS 222 were studied on the haematology of *Cyprinus carpio*, *Sarotherodon mossambicus* and *Salmo gairdneri*. As judged from the results, MS 222, which is acidic in nature, produced haemo-concentration effects in all species studied, being least in the trout followed by carp and *Sarotherodon mossambicus*. These differences are ascribed to acid-base regulatory functions and metabolic activities of the fish species investigated. The use of neutralized MS 222 improved the haematological profiles markedly and resulted in stabilization of acid-base parameters and red blood cells sizes and numbers. Haemoconcentration effects, however, still persisted. Trout were found to be more susceptible to the stress of MS 222 anaethesia than carp and *Sarotherodon mossambicus*.

80-001702 Smit, G. L.; J. Hattingh and A. P. Burger. HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS 222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: INTERSPECIES DIFFERENCES. *J. Fish Biol.* 15(6):633-643. Dec. 1979. SFA 25(2)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa] Interspecies haematological differences to MS 222 and neutralized MS 222 anaesthesia were investigated in *Sarotherodon mossambicus*. *Cyprinus carpio* and *Salmo gairdneri* acclimated under identical laboratory conditions. Anaethesia with MS 222 resulted in a 'chemical stress' in all fish, as was evident from change in the haematological profiles of the animals. Such species specific variations in the haematology persisted throughout the whole experiment protocol which employed different concentrations of the anaesthetic. The use of netralized MS 222, whereby aquarium water quality remained unchanged, improved the haematological profile. Possible reasons for the interspecies differences observed are discussed.

80-001703 Smit, G. L.; J. Hattingh and A. P. Burger. HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS 222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: HAEMOGLOBIN ELECTROPHORESIS, ATP LEVELS AND CORPUSCULAR FRAGILITY CURVES. *J. Fish Biol.* 15(6):655-663. Dec. 1979. SFA 25(2)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa] The effects of MS 222 and neutralized MS 222 anaethesia on haemoglobin electrophoresis, erythrocyte adenosine triphosphate (ATP) levels and corpuscular fragility curves were studied in *Cyprinus carpio*, *Sarotherodon mossambicus* and *Salmo gairdneri*. Haemoglobin electrophoresis showed no significant intra-species differences in the percentage composition of the various fractions for any concentration of MS 222 and neutralized MS 222 used. Significant interspecies differences were, however, still observed. ATP levels showed intra- and interspecies differences ascribed to the response of the fish species to MS 222-induced stress and not to actual change in erythrocyte ATP concentrations. Differences were also observed in corpuscular fragility curves for all three species when using MS 222 or neutralized MS 222 compared to curves obtained without the use of the anesthetic, but the mechanisms involved are not clear.

80-001704 Spehar, R. L.; J. T. Fiandt; R. L. Anderson and D. L. DeFoe. COMPARATIVE TOXICITY OF ARSENIC COMPOUNDS AND THEIR ACCUMULATION IN INVERTEBRATES AND FISH. *Arch. Environ. Contam. Toxicol.* 9(1):53-63. 1980.

TOXICOLOGY; BIOASSAYS

80-001704 CONTINUED SFA 25(2)
[U.S. EPA, 6201 Congdon Blvd., Duluth, MN 55804]

80-001705 Sudershan, P. and M. A. Q. Khan. METABOLIC AND ELIMINATION PRODUCTS OF [^{14}C]PHOTODIELDRIN FROM BLUEGILL FISH. *Pestic. Biochem. Physiol.* 12(3):216-223. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Univ. Ill., Box 4348, Chicago 60680]

80-001706 Sugatt, R. H. EFFECTS OF SODIUM DICHROMATE EXPOSURE ON THE IMMUNE RESPONSES OF JUVENILE COHO SALMON, *ONCORHYNCHUS KISUTCH*, AGAINST *VIBRIO ANGUILLARUM*. *Arch. Environ. Contam. Toxicol.* 9(2):207-216. 1980. SFA 25(2)
[Life Sci. Div., Syracuse Research Corp., Syracuse, NY 13210]

80-001707 Sugatt, R. H. EFFECTS OF SUBLETHAL SODIUM DICHROMATE EXPOSURE IN FRESHWATER ON THE SALINITY TOLERANCE AND SERUM OSMOLALITY OF JUVENILE COHO SALMON, *ONCORHYNCHUS KISUTCH*, IN SEAWATER. *Arch. Environ. Contam. Toxicol.* 9(1):41-52. 1980. SFA 25(2)
[Life Sci. Div., Syracuse Res. Corp., Syracuse, NY 13210]

80-001708 Tomasso, J. R.; C. A. Goudie; B. A. Simco and K. B. Davis. EFFECTS OF ENVIRONMENTAL pH AND CALCIUM ON AMMONIA TOXICITY IN CHANNEL CATFISH. *Trans. Am. Fish. Soc.* 109(2):229-234. Mar. 1980. SFA 25(2)
[Ecol. Res. Cent., Dep. Biol., Memphis State Univ., Memphis TN 38152]

80-001709 Tsai, C. and J. A. McKee. ACUTE TOXICITY TO GOLDFISH OF MIXTURES OF CHLORAMINES, COPPER, AND LINEAR ALKYLATE SULFONATE. *Trans. Am. Fish. Soc.* 109(1):132-141. Jan. 1980. SFA 25(2)
[Chesapeake Biol. Lab., Cent. Environ. Estuarine Stud., Univ. Md., Solomons 20688]

80-001710 Vrochinskiy, K. K. and G. V. Zemkov. PHYSIOLOGICAL-BIOCHEMICAL DATA ON EXPERIMENTAL INTOXICATION OF FISH WITH "YALAN". *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1004-1009. 1978. SFA 25(2)
[KaspNIIRKh, Astrakhan, USSR] The limits of the toxicity of the herbicide "yalan" for 8 day old larvae of the carp, *Cyprinus carpio* were established. At the moment of intoxication the motor activity is decreased in second year carp with simultaneous increase in the amount of ammonia, urea and hydroperoxides of the lipids in the dorsal white muscle. The amount of glucose in the blood is simultaneously reduced.

80-001711 Tschirn, R. S.; A. R. Isensee and E. A. Walker. BEHAVIOR OF TRIFLURALIN IN AQUATIC MODEL ECOSYSTEMS. *Bull. Environ. Contam. Toxicol.* 24(1):134-141. Jan. 1980. SFA 25(2)
[Pestic. Degradation Lab., USDA, Beltsville, MD 20705]

FISH TOXICANTS

80-001712 Orciari, R. D. ROTENONE RESISTANCE OF GOLDEN SHINERS FROM A PERIODICALLY RECLAIMED POND. *Trans. Am. Fish. Soc.* 108(6):641-645. Nov. 1979. SFA 25(2)
[Conn. Dep. Environ. Prot., Middlebury 06762]

RESEARCH AND MANAGEMENT-GENERAL

80-001713 Haussler, R. B. CALIFORNIA'S FRESHWATER ENVIRONMENTAL PROBLEMS. *Cal-Neva Wildl.* 1979:45-54. 1979. SFA 25(2)
[Calif. Energy Comm., Environ. Eng. Div., Sacramento] Limited water resources in California have resulted in intense competition for available supplies. Environmental and institutional constraints presently limit the potential for siting thermal electric power plants near coastal waters of California. Consequently, the search for viable sites has moved inland, away from the coast, where the utility companies must compete with various interests such as agriculture, for water supplies necessary for cooling purposes. A power plant siting proposal before the Energy Commission serves as an example of the varied considerations which must be made as a result of the current dilemma.

80-001714 Melteff, B. R., ed. ALASKA FISHERIES: 200 YEARS AND 200 MILES OF CHANGE. *Proc. Alaska Sci. Conf.* 29:1-796. Aug. 1979. SFA 25(2)
A collection of papers.--RS

80-001715 Peterman, R. M. DYNAMICS OF NATIVE INDIAN FOOD FISHERIES ON SALMON IN BRITISH COLUMBIA. *Can. J. Fish. Aquatic Sci.* 37(4):561-566. Apr. 1980. SFA 25(2)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

80-001716 Saunders, R. L. THE STOCK CONCEPT - A MAJOR CONSIDERATION IN SALMON RESTORATION. *N. Am. Salmon Res. Cent. Rep.* No. 3. 6p. 1979. SFA 25(2)
[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada]

80-001717 Shupp, B. D. 1978 STATUS OF BASS FISHING TOURNAMENTS IN THE UNITED STATES. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):11-18. Nov.-Dec. 1979. SFA 25(2)
[Box 278, Chestertown, NY 12817]

80-001718 Temple, R. WARM-WATER FISH MANAGEMENT IN OREGON. *Oreg. Wildl.* 35(2):3-7. Feb. 1980. SFA 25(2)
[Oreg. Div. Wildl., Portland 97208]

ADMINISTRATION AND PLANNING

80-001719 Platts, W. S. A PLEA FOR FISHERY HABITAT CLASSIFICATION. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):2-6. Jan.-Feb. 1980. SFA 25(2)
[U.S. For. Serv. Range Exp. Stn., Boise, ID] Fishery biologists do not have a workable system for classifying the fishery habitat. As a result, our work in land use planning and management has been difficult. This article describes why a classification is needed, what the classification should be composed of, and what it will accomplish. The author requests that the American Fishery Society be the guiding organization in the development of fishery habitat classification.

ADMINISTRATION AND PLANNING

80-001720 Platts, W. S. INCLUDING THE FISHERY SYSTEM IN LAND PLANNING. *U.S. For. Serv. Intermountain For. Range Exp. Stn. Gen. Tech. Rep.* GTR-INT-60. 1979. SFA 25(2)

[U.S. For. Serv., Intermountain For. Range Exp. Stn., 316 E. Myrtle St., Boise, ID 83706] The USDA Forest Service uses a geomorphic analysis that classifies units of land in its Land Systems Inventory. This inventory provides managers with a description of the geology, geomorphic processes, and watershed conditions within any given area of land. Similar areas of land can then be identified, classified, and mapped. The inventory information is then used to determine the type and intensity of land uses each of these stratified land areas can provide and still protect the environment and allows land managers to intelligently plan for future land uses. Although the system provides some protection for the aquatic environment, the inventory, built on terrestrial descriptions, does not provide the information needed for managing aquatic resources. Through the study reported here, a system was developed to integrate all streams and their fisheries into the Land Systems Inventory at the landtype association level and to include most streams and their fisheries at the landtype level of planning. This integration was possible because similar lands in the natural state also have similar streams and fisheries. Similar lands have similar fisheries because watersheds influence the development of the abiotic and biotic components of the stream. The abiotic components of the stream dictated fish biomass and species composition. Therefore, fish biomass and species composition can be determined at levels of accuracy needed in land use planning by using the Land Systems Inventory that identifies similar lands. Thus for the first time the land-manager has a planning system covering large areas that includes both the terrestrial and aquatic environments in the final allocation of resources.

REPORTS OF FISHERY STATIONS, STATES, ETC.

80-001721 Foyle Fisheries Commission. REPORT FOR THE YEAR ENDED DECEMBER 31ST 1978. *Foyle Fish. Comm. Annu. Rep.* 27:1-61. 31 Mar. 1979. SFA 25(2)

[Belfast, Northern Ireland]

HABITAT ALTERATIONS

80-001722 Baxter, R. M. and P. Glaude. ENVIRONMENTAL EFFECTS OF DAMS AND IMPOUNDMENTS IN CANADA. EXPERIENCE AND PROSPECTS. *Can. Bull. Fish. Aquatic Sci.* 205. vi + 34p. 1980. SFA 25(2)

[Dep. Environ., Natl. Water Res. Inst., Burlington, ON L7R 4A6, Canada] Although dams and reservoirs have contributed immeasurably to the well-being of Canadians they may have side effects which may be detrimental to the environment and to human welfare. In this Bulletin, the authors survey the environmental consequences that have ensued from dam construction and the impoundment of water in Canada in the past, and attempt to alert environmentalists and engineers to the types of problems that may be associated with such activities in the future. Some of these effects are immediate, direct, and obvious, such as the loss of resources by flooding, interference with the passage of fish, and environmental damage and pollution as a result of construction activities. Others may manifest themselves only over a period of time, such as changes in water chemistry and modification of the new shoreline. This last is likely to be of particular importance in reservoirs on permafrost. Large impoundments may influence the climate in their vicinities and sometimes induce earthquakes. Still other consequences follow from the mode of operation of the reservoir. Low-level discharge through turbines may radically alter the temperature regime in the stream below. The induction of an unnatural seasonal pattern of water level

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80-001722 CONTINUED fluctuation may lead to the formation of a virtually barren drawdown zone around the reservoir, and induce geographical and ecological changes downstream, sometimes at great distances. Many of these effects act in various and sometimes opposing ways on the living organisms in the reservoir and the stream so that the ultimate biological consequences often cannot be confidently predicted. It is sometimes difficult to reconcile the interests of those who stand to benefit from a given project and the interests of others who are likely to suffer a loss from it. This conflict is particularly acute when the project affects communities of native peoples following a traditional way of life. Such fragile societies are likely to be gravely disrupted unless particular care is taken.

80-001723 Bella, D. A. and K. J. Williamson. DIAGNOSIS OF CHRONIC IMPACTS OF ESTUARINE DREDGING. *J. Environ. Syst.* 9(4):289-311. 1979-80. SFA 25(2)
[Dep. Civ. Eng., Oreg. State Univ., Corvallis 97330] A method for identifying environmental impacts to estuarine sediments has been developed and applied to Coos Bay, Oregon. This approach is directed towards early phases of environmetal impact assessment and appears to be effective for promoting truly interdisciplinary efforts. Physical, chemical and biological characteristics are sketched on a two-dimensional plot of organic content of the sediment (OCS) versus rate of sediment turnover (RST). These plots are overlayed to given common characteristics. Movements of stations on the plane are identified as chronic impacts.

80-001724 Belt, G. H. PREDICTING STREAMFLOW CHANGES CAUSED BY FOREST PRACTICES USING THE EQUIVALENT CLEARCUT AREA MODEL. *Univ. Idaho For. Range Wildl. Exp. Stn. Bull.* No. 32. 11p. Jan. 1980. SFA 25(2)
[Coll. For., Univ. Idaho, Moscow 83843]

80-001725 Dudley, R. G. and K. N. Black. DISTRIBUTION OF STRIPED BASS EGGS AND LARVAE IN THE SAVANNAH RIVER ESTUARY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:561-570. 1978[1979]. SFA 25(2)
[Sch. For. Resour., Univ. Ga., Athens 30602] A tide gate on the Savannah Back River, constructed by U.S. Army Corps of Engineers, might decrease survival of the striped bass (*Morone saxatilis*) eggs and larvae spawned near Savannah, Georgia. An initial season of sampling, with the tide gate held open, yielded striped bass eggs and larvae both up- and downstream from the gate. The distribution of eggs and larvae under normal conditions was established. Maximum numbers of striped bass eggs did not reveal $2/m^3$. Spawning occurred at temperatures between 17 and 23 C but 3 spawning peaks coincided with temperatures between 19.5 and 21 C. Slightly more eggs were found farther upstream during the last spawning peak. All stations sampled yielded eggs or larvae at some time, but stations in Back River generally produced the most eggs. Significant numbers of eggs were found in sections of the river flanked by industry but many of these eggs orignated in other areas of the river. Because it alters river flow patterns, the tide gate: 1) may incrase the likelihood that striped bass eggs and larvae will move into polluted sections of the river, 2) may incrase the distance which striped bass eggs and larvae are transported downstream, and 3) will increase the likelihood that eggs will encounter waters of higher salinities.

80-001726 Dugas, R.; V. Guillory and M. Fischer. OIL RIGS AND OFFSHORE SPORT FISHING IN LOUISIANA. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):2-8, 10. Nov.-Dec. 1979. SFA 25(2)

HABITAT ALTERATIONS

80-001727 Galvin, M. MANAGEMENT OF TRANSMISSION LINE RIGHTS-OF-WAY FOR FISH AND WILDLIFE. *U.S. Fish Wildl. Serv.* FWS/OBS-79/22. 1979. SFA 25(2)
[Asplundh Environ. Serv., Blair Mill Rd., Willow Grove, PA 19090]

80-001728 Gregg, R. E. and E. P. Bergersen. *MYSIS RELICTA*: EFFECTS OF TURBIDITY AND TURBULENCE ON SHORT-TERM SURVIVAL. *Trans. Am. Fish. Soc.* 109(2):207-212. Mar. 1980. SFA 25(2)
[Off. Surface Mining, 1823 Stout St., Denver, CO 80210]

80-001729 Gurtz, M. E.; J. R. Webster and J. B. Wallace. SESTON DYNAMICS IN SOUTHERN APPALACHIAN STREAMS: EFFECTS OF CLEAR-CUTTING. *Can. J. Fish. Aquatic Sci.* 37(4):624-631. Apr. 1980. SFA 25(2)
[J. R. Webster: Dep. Biol., VPI&SU, Blacksburg, VA 24061]

80-001730 Holland, H. T.; J. R. Chambers and R. R. Blackman. EFFECTS OF DREDGING AND FILLING FOR BEACH EROSION CONTROL ON FISHES IN THE VICINITY OF LIDO KEY, FLORIDA. *U.S. Army Corp Eng., Jacksonville, Fla.* 28p. Mar. 1980. SFA 25(2)
[U.S. Army Corps Eng., P.O. Box 4970, Jacksonville, FL 32201] Fish populations in the vicinity of Lido Key, Florida, were studied before (one survey) and after (four surveys) completion of a beach erosion control project utilizing an offshore borrow source. Fishes were collected with a trawl and beach seines during the period April 1970 to May 1971; a total of 63 species were collected, 58 by trawling and 26 in seines. Mean catch in trawl samples ranged from 10.2 in May of 1971 to 91.1 in October 1970, whereas seine catches ranged from 27.3 in April 1970 to 163.2 in July 1970. The most numerous species for all collections was *Menticirrhus littoralis*, followed by, in order of decreasing abundance, *Harengula pensacolae*, *Bairdiella chrysura*, *Chloroscombrus chrysurus*, and *Cynoscion arenarius*. The data suggest that the beach erosion control project resulted in at least a temporary increase in fishes along the beach and near the borrow area. Further detailed investigations appear warranted in view of the limitations of the present study and the increasing Federal and State role in restoring eroded or eroding beaches.

80-001731 Marsh, P. C. and T. F. Waters. EFFECTS OF AGRICULTURAL DRAINAGE DEVELOPMENT ON BENTHIC INVERTEBRATES IN UNDISTURBED DOWNSTREAM REACHES. *Trans. Am. Fish. Soc.* 109(2):213-223. Mar. 1980. SFA 25(2)
[Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul 55108]

80-001732 Parkinson, E. A.; P. A. Slaney and T. G. Halsey. SOME EFFECTS OF FOREST HARVESTING ON A CENTRAL INTERIOR LAKE IN BRITISH COLUMBIA. *British Columbia Minist. Recreation Conserv. Fish. Manage. Rep.* No. 17. 48p. Sept. 1977. SFA 25(2)
[Fish. Wildl. Br., Fish. Res. Tech. Serv. Sect., c/o I.A.R.E., Hut B-8, Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-001733 Raymond, H. L. EFFECTS OF DAMS AND IMPOUNDMENTS ON MIGRATIONS OF JUVENILE CHINNOK SALMON AND STEELHEAD FROM THE SNAKE RIVER, 1966 TO 1975. *Trans. Am. Fish. Soc.* 108(6):505-529. Nov. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001734 Robinson, J. L. and M. A. Smith. STREAM MORPHOLOGY IN TWO ADJACENT GRAZING SYSTEMS OF MEDICINE BOW MOUNTAINS OF WYOMING. *J. Colo.-Wyo. Acad. Sci.* 12(1):12. Apr. 1980. Abstract only. SFA 25(2)

HABITAT ALTERATIONS

80-001734 CONTINUED
[Univ. Wyo., Laramie] This report presents the results of studies conducted on Pole Mountain, in the Medicine Bow National Forest, East of Laramie. Wyoming. This study evaluated stream morphology in continuous and deferred rotation grazing allotments. Seven (7) parameters were studied in each allotment along two stream flowing through both allotments. An increase in undercut banks was noted in the deferred allotment. Undercut banks are indicative of bank stability and are valuable trout cover. Increased bank stability was also indicated by an increase in stream/channel width ratio and improvements in percent of channel depth with water, steeper bank slope, coarser bottom materials, and better length and dispersion of pools, riffles, and runs in the deferred rotation grazing allotment. An unexpected finding was noted in overhead cover. The continuous grazing allotment had the highest total percent of cover over water. This was due primarily to washed in debris from dead woody species. The value of the washed in debris to any given site is limited because of its transitory nature. The washed in debris is more indicative of the loss of live woody species. Fish population surveys provided by Wyoming Game and Fish indicate population increases in Brook trout in the deferred/rotation streams. Survey data indicates Brook trout populations increased 226% in pounds per acre and 39% in the number of trout per mile. The combined results of this study, especially in light of the fish population increase, suggests the value of deferred grazing as a fisheries management tool.

80-001735 Shuldiner, P. W.; D. F. Cope and R. B. Newton. ECOLOGICAL EFFECTS OF HIGHWAY FILLS ON WETLANDS. USER'S MANUAL. *Natl. Coop. Highway Res. Prog. Rep.* 218B. 99p. Dec. 1979. SFA 25(2)
[Univ. Mass., Amherst]

80-001736 Slaney, P. A.; T. G. Halsey and A. F. Tautz. EFFECTS OF FOREST HARVESTING PRACTICES ON SPAWNING HABITAT OF STREAM SALMONIDS IN THE CENTENIAL CREEK WATERSHED, BRITISH COLUMBIA. *British Columbia Minist. Recreation Conserv. Fish. Manage. Rep.* No. 73. ii + 45p. Nov. 1977. SFA 25(2)
[Fish. Wildl. Br., Fish. Res. Tech. Serv. Sect., c/o I.A.R.E., Hut B-8, Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-001737 Thorhaug, A. and J. H. Marcus. POTENTIAL ARTIFICIAL REEFS CREATED BY THE PRESENCE OF OCEAN THERMAL ENERGY CONVERSION (OTEC) PLANTS. *Fla. Sci.* 43(Suppl. 1):18. 1980. Abstract only. SFA 25(2)
[Fla. International Univ., Tamiami Campus, Miami 33199] It is likely that organisms (attached algae, coral, invertebrates and browsing fish) will be attracted to and/or attach to Ocean Thermal Energy Conversion (OTEC) structures creating an artificial reef. Growth-promoting substances such as nitrogen and phosphate, heat and increased lighting could create an area of fertility surrounding the plant which would enhance the productivity of such a reef. A literature survey has been undertaken to assemble available information on colonization of existing structures submerged in localities similar to those proposed for OTEC, e.g., oil platforms, buoys, light ships and long ocean piers. Information is also being gathered on major attached organisms, e.g., their biological mass and colonization rate, at the Mini-OTEC and OTEC-1 sites in Hawaii and also at proposed sites such as Tampa, Puerto Rico and Miami.

80-001738 Walton, J. M. PUGET SOUND ARTIFICIAL REEF STUDY. *Ph.D. dissertation, Univ. Wash.* 142p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2494. Dec. 1979. SFA 25(2)

HABITAT ALTERATIONS

80-001738 CONTINUED
Eight artificial reef habitats were surveyed through the use of SCUBA transects for density, biomass and species assemblages of potential sport species of fish from April 1975 to May 1978. The open sand bottom at a depth of 6 to 18 m and four existing artificial habitats, including a quarry rock breakwater, a rubble rock pipeline covering, a concrete sewage outfall block and several sunken boat hulls preserved as an underwater park, were surveyed the first year. Four reef configurations utilizing automobile tires were designed, constructed, and evaluated during the latter period of the study. These structures included a flatsquare, triads, horseshoes and pyramids. Five species of flatfish were commonly associated with the open sand bottom at a density of .06 fish/m^2 and a fish biomass of 6.9 g/m^2. The average density of 24 species of fish on the existing artificial habitats (.23 fish/m^2) was about 4 times greater than determined for the flatfish on the sand bottom, and the average biomass (50.2 g/m^2) was about 9 times greater. The optimum reef structure was the medium high relief triad design with an average density estimate of 2.13 fish/m^2 and a biomass estimate of 285.7 g/m^2. The horse shoe-shaped tire reefs, designed to concentrate flatfish, yielded mean flatfish, density and biomass estimates about 4 times greater than that observed on the open sand. The average density of fish on all the tire reef structures was .53 fish/m^2 and the biomass 56.7 g/m^2 or about 8 times that observed on the open sand. Three species of surfperch, family Embiotocidae, accounted for 65% of the density and 30% of the biomass of the fish present. Rockfishes of the family Scorpaenidae comprised 33% of the density and about 53% of the biomass. Although the artificial reefs hosted about 16 times the fish density found on natural reefs in Puget Sound, the biomass was about the same.--From abstr.

80-001739 Woods, P. F. DISSOLVED OXYGEN IN INTRAGRAVEL WATER OF THREE TRIBUTARIES TO REDWOOD CREEK, HUMBOLDT COUNTY, CALIFORNIA. *Water Resour. Bull.* 16(1):105-111. Feb. 1980. SFA 25(2)
[USGS, Helena, MT 59601] As a part of a study of Redwood National Park in northwestern California, an investigation was conducted from June to November 1974 on intragravel dissolved oxygen and sediment in three tributaries to Redwood Creek, a major coastal stream that flows through Redwood National Park. Of concern was whether the intragravel environment of streams in logged and unlogged redwood-forested drainage basins was different. The tributary in the unlogged drainage basin had lower percentages of fine streambed sediment than either of the tributaries in logged drainage basins. Concentration and percentage saturation of dissolved oxygen of intragravel water were highest in the stream in the unlogged drainage basin, intermediate in the stream in the patch-cut drainage basin, and lowest in the stream in the clear-cut drainage basin. The differences in intragravel dissolved-oxygen conditions among the three tributaries are attributed chiefly to differences in their interchange of surface and intragravel water. The larger quantities of fine streambed sediment in the two streams in logged basins may have reduced the permeability of the streambeds and hence their capacity to interchange surface and intragravel water. However, differences in the lithology of the three tributary drainage basins examined may contribute to the differences in the percentage of fine sediments observed among the streams, even in the absence of logging.

HARVEST, CREEL CENSUS, ETC.

80-001740 Alexander, C. M. and J. A. Holbrook II. COMPARISON OF BASS CLUB RECORDS WITH CREEL CENSUSES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:446-448. 1978[1979]. SFA 25(2)

HARVEST, CREEL CENSUS, ETC.

80-001740 CONTINUED
[TVA, Norris, TN 37828] Bass club catch records from tournaments held on Norris, Douglas, and Cherokee Reservoirs during 1976 were compared with creel censuses. While not statistically significant, both numbers and weights per hour of bass caught by tournament anglers were less than catch rates by nontournament fishermen. Average weight of bass caught in tournaments was higher than that found in creel censuses. Some advantages of using tournament catch records in evaluating bass fisheries are discussed.

80-001741 Christensen, D. J. and W. J. Clifford. COMPOSITION OF CATCHES MADE BY ANGLERS FISHING FOR SUMMER FLOUNDER, *PARALICHTHYS DENTATUS*, FROM NEW JERSEY PARTY BOATS IN 1978. *Mar. Fish. Rev.* 41(12):28-30. Dec. 1979. SFA 25(2)
[NMFS, Sandy Hook Lab., Highlands, NJ 07732] Anglers were interviewed while fishing for summer flounder, *Paralichthys dentatus* along the New Jersey coast from party boats. Mean seasonal catch rates for full-day and half-day anglers were 3.15 and 1.86 summer flounder per man per trip, respectively, from 19 June to 1 September 1978. Other fish species made up less than 10 percent of the catch. A total of 828 summer flounder were measured and ages were determined for 427 specimens. Analysis of the age-length data indicates that II +, III +, IV +, V +, and >V + age summer flounder made up 4.3, 73.0, 20.3, 1.8, and 0.6 percent of the catch, respectively.

80-001742 Hanson, W. D. and J. G. Dillard. RECREATIONAL USE OF THOMAS HILL RESERVOIR AND ADJOINING LANDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:459-469. 1978[1979]. SFA 25(2)
[Mo. Dep. Conserv., Columbia 65201] An estimate of the total recreational use of the Thomas Hill Wildlife Area (1,778 ha reservoir and 2,424 ha of adjoining lands) in northern Missouri was made from 1 July 1972 to 30 June 1974. Recreational activity was determined by interviewing departing recreationists utilizing the non-uniform probability sampling technique. There were an estimated 219,700 recreational trips totaling 1,398,900 hours during the 2-year study. Twenty-two recreational activities were measured. Seven recreational uses; sight-seeing, boating, fishing, camping, swimming, picnicking, and hunting accounted for over 99% of all the trips and hours. Sight-seeing made up 25%, boating 21%, angling 20%, camping 16%, and swimming 9% of the total trips. However in hours, camping made up 42%, boating 22%, angling 21%, and swimming 6% of the total. There were 63 trips per water surface ha and approximately 45 trips per land surface ha. Anglers caught an estimated 172,100 fish during the study. A catch rate of 0.6 fish per hour provided a harvest of 97 fish per ha. White crappie (*Pomoxis annularis*) (87%) dominated the catch. Deer, rabbits, squirrels, predators, quail, and ducks were harvested. Harvest rates varied from 0.1 per hour for predators to 0.7 per hour for squirrels. Local residents made up 48% of all visitors while 78% came from within a 120-km radius. Recreationists came from 56 Missouri counties and from out-of-state. About 48% of all visitors held some type of Department license; many who did not were too young or too old to need a fishing license. The Thomas Hill Wildlife Area increased available public recreational opportunity in this region of the state and was important to North Central Missourians.

80-001743 Hess, T. B. CHARACTERISTICS OF 1975-76 GEORGIA RESIDENT FISHING LICENSE HOLDERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:727-731. 1978[1979]. SFA 25(2)
A 1975-76 resident fishing license holder survey was conducted to obtain data on the characteristics of Georgia anglers. Sixty-four percent of all anglers were men. The average number of fishing trips per person per year was

HARVEST, CREEL CENSUS, ETC.

80-001743 CONTINUED 17. More anglers fished in ponds at least once (51%) than in any other type of water. Mountain streams supported the heaviest fishing pressure (182 trips/ha). Nearly half of all anglers (45%) supported an increase in license fees if the funds were used solely for fisheries management purposes.

80-001744 Howard, I. C. OPINIONS, PREFERENCES, SATISFACTIONS, AND IMPORTANCE OF WOMEN ANGLERS IN MASSACHUSETTS. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):32-34. Nov.-Dec. 1979. SFA 25(2)
[185 Allen Ave., Newton, MA 02168]

80-001745 Internation Commission for the Northwest Atlantic Fisheries. LIST OF NORTHWEST ATLANTIC SPECIES ARRANGED ACCORDING TO THE ICNAF GROUPS. *Int. Comm. Northwest Atl. Fish. Stat. Bull.* 27:1-229. 1979. SFA 25(2)
[Dartmouth, Nova Scotia, Canada]

80-001746 King, T. R.; R. R. Thompson and J. C. Buntz. COMPARISON OF ATTITUDES OF AVERAGE FISHERMEN AND FISHING CLUB MEMBERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:657-665. 1978[1979]. SFA 25(2)
[Commum. Res. Cent., Fla. State Univ., Tallahassee 32306] A telephone survey was conducted of a stratified, random sample of people holding Florida fishing licenses and of a random sample of members of selected fishing clubs. Questions were asked concerning demographic characteristics, their fishing habits and preferences, opinions about the Florida Game and Fresh Water Fish Commission and its projects, and their sources of information on freshwater fishing topics. A statistically significant difference was found between the responses of the average fishermen and the fishing club members in 72% of the questions asked in the survey.

80-001747 Manning, R. E. BEHAVIORAL CHARACTERISTICS OF FISHERMEN AND OTHER RECREATIONISTS ON FOUR VERMONT RIVERS. *Trans. Am. Fish. Soc.* 108(6):536-541. Nov. 1979. SFA 25(2)
[Sch. Nat. Resour., Univ. Vt., Burlington 05405]

80-001748 Oliphant, M. S. CALIFORNIA MARINE FISH LANDINGS FOR 1976. *Calif. Dep. Fish Game Fish Bull.* 170. 56p. 1979. Available from Mar. Tech. Inf. Cent., Calif. Dep. Fish Game, 350 Golden Shore, Long Beach 90802. SFA 25(2)

REGULATIONS

80-001749 Bouc, K. FISHING'S FUTURE WALLEYE SIZE LIMIT. *Nebraskaland* 58(4):14,48,50. Apr. 1980. SFA 25(2)

80-001750 Huntsman, G. R. and C. S. Manooch III. MINIMUM SIZE LIMITS FOR REEF FISHES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:509-513. 1978[1979]. SFA 25(2)
[NMFS, Southeast Fish. Cent., Beaufort Lab., Beaufort, NC 28516] Implementation of minimum size limits is an administratively simple method of maximizing yield-per-recruit and, probably, total yield from reef fisheries. However, size limits may not guarantee ample escapement to older ages and, consequently, adequate reproduction of those species which undergo sex reversal. Further, size limits may place unacceptably severe restriction on

REGULATIONS

80-001750 CONTINUED certain portions of reef fisheries. Finally, most undersize reef fishes taken by hook and line from deep water will likely die of injuries caused by the pressure change. Based on growth data of fishes from the United States South Atlantic, Gulf of Mexico or southern Caribbean, size limits (TL) that would maximize yield-per-recruit for the following species are: *Pagrus pagrus*, 369 mm; *Rhomboplites aurorubens*, 324 mm; *Haemulon plumieri*, 314 mm; *Lutjanus campechanus*, 407 mm; *Lutjanus synagris*, 356 mm; *Ocyurus chrysurus*, 403 mm; *Centropristis striata*, 233 mm; *Epinephelus morio*, 635 mm; *Epinephelus guttatus*, 363 mm; and *Mycteroperca microlepis*, 649 mm.

80-001751 Kushnarenko, A. I. THE MINIMUM COMMERCIAL SIZE AND NATURAL MORTALITY OF THE NORTH CASPIAN ROACH, *RUTILUS RUTILUS CASPICUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):886-895. 1978. SFA 25(2)
[Caspian Fish. Res. Inst., Astrokhan, USSR] The effectiveness of the existing minimum commercial size on *Rutilus rutilus caspicus* is considered. The biomass of the North Caspian roach reaches its maximum in 3-year-old fish from catches with commercial seines and in 2-year-old fish from catches with experimental (fine-mesh) seines. Presentday fishing gear, which catches mainly 5-year-old fish, clearly does not effectively utilize the North Caspian roach. Categories of mortalities have been established. Mortality due to natural causes are 87.475 X 10^6 kg (11.965.1 X 10^6 fish), of which 75.2% (by weight) and 98.7% (by number) are fish not of commercial size. The natural mortality of the North Caspian roach is more than 4 times the fishing mortality. It is proposed to increase the catch by rational exploitation of the age groups of sexually mature fish.

80-001752 Weithman, A. S. RECYCLING TROUT... *Mo. Conserv.* 41(3):8-9. Mar. 1980. SFA 25(2)
[Mo. Dep. Conserv., Columbia]

FISH CONTROL AND REMOVAL

80-001753 Flint, R. A. CHEMICAL TREATMENT OF THE NORTH FORK FEATHER RIVER, BUTTE AND PLUMAS COUNTIES, CALIFORNIA, 1977. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-4. 25p. Feb. 1980. SFA 25(2)
In September and October 1977 the California Department of Fish and Game chemically treated 35 miles of streams and 194 acres of reservoirs in the North Fork Feather River drainage in an effort to greatly reduce hardhead, *Mylopharodon conocephalus*; Sacramento squawfish, *Ptychocheilus grandis*; and Sacramento sucker, *Catostomus occidentalis*. Rotenone was used in the reservoirs and parts of the streams at application rates of 0.025 to 0.055 mg/l (ppm) active ingredient. Antimycin A was applied to other parts of the streams at rates of 11.4 to 17.1 µg/l (ppb) active ingredient. Total project cost was $13,231, with $8,705 expended for chemicals. After treatment the streams and reservoirs were restocked in 1977 with 20,010 fingerling rainbow trout, *Salmo gairdneri* and 41,420 fingerling brown trout, *Salmo trutta*. Angling regulations were changed to a two-fish daily limit, with the intention of managing the system as a trophy trout fishery and to encourage predation by trout on nongame fish to prevent their reestablishment as the dominant fishes.

MARKING AND TAGGING

80-001754 Bryant, M. D. and W. J. Walkotten. CARBON DIOXIDE FREEZE-BRANDING DEVICE FOR USE ON JUVENILE SALMONIDS. *Prog. Fish-Cult.* 42(1):55-56. Jan. 1980. SFA 25(1)
[U.S. For. Serv., Pac. Northwest For. Range Exp. Stn., Juneau, AK 99801]

80-001755 Gunnes, K. and T. Refstie. COLD-BRANDING AND FIN-CLIPPING FOR MARKING OF SALMONIDS. *Aquaculture* 19(3):295-299. Mar. 1980. SFA 25(2)
[Dep. Anim. Genet. Breed., Agric. Univ. Norway, 1432 ÅS-NLH, Norway] Identification of individual fish is important under many research circumstances and is essential in breeding and selection work. Results are presented from the marking system used at the Norwegian Research Station for Salmonids. Trained personnel and good light conditions are necessary to obtain a high percentage of correct identifications. The best result obtained was 99% identification 22-28 months after marking. It is estimated that 1.4% of the fish read were incorrectly identified. The frequency of misidentified fish was higher when different cold-branded symbols were included in the system, increasing to a mean of 8% for salmon and 15% for rainbow trout. Cold-branding using five different symbols at two of six different positions on the fish gives 600 permutations when used in conjunction with clipping of the adipose and right or left pelvic fins. A satisfactory degree of correct identification is possible for use in a programme of selection in salmonids.

80-001756 Hedgepeth, M. Y.; W. H. Kriete, Jr. and J. V. Merriner. DETERIORATION OF FLOY FD-67 INTERNAL ANCHOR TAGS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:648-656. 1978[1979]. SFA 25(2)
[Va. Inst. Mar. Sci., Gloucester Point 23062] Yellow Floy FD-67 internal anchor tags were utilized in an experimental and field study of tag discoloration, tag legibility and fouling organisms. Most tags exhibited some degree of discoloration over time. The rate and extent of discoloration varied between two batches of tags purchased in different years. The legibility of a tag was not affected to a great extent by the degree of discoloration. Legends of some completely discolored tags were still readable. Fouling organisms eroded the vinylite covering and deteriorated the legends of some tags. Bryozoans, barnacles and tunicates were the most commonly encountered fouling organisms. Barnacles were the most erosive of these organisms. Other causes of tag discoloration were believed to be chemical reactions between the vinylite covering and environmental factors such as salt concentration.

80-001757 Russell, H. J., Jr. ANALYSIS OF DOUBLE-TAGGING EXPERIMENTS: AN UPDATE. *Can. J. Fish. Aquatic Sci.* 37(1):114-116. Jan. 1980. In English with French summ. SFA 25(2)
[New England Fish. Manage. Counc., Peabody, MA 01960]

STOCKING AND INTRODUCTIONS

80-001758 Axon, J. R. AN EVALUATION OF STRIPED BASS INTRODUCTIONS IN HERRING LAKE. *Ky. Dep. Fish. Wildl. Resour. Fish. Bull.* No. 63. 33p. Oct. 1979. SFA 25(2)
[100 Buffalo Tr., Frankfort, KY 40601] Herrington Lake was stocked with sub-adult striped bass in 1958 and 1960-62. One- to two-inch fingerlings were introduced in 1969-70 and 1973-78. The fingerling stocking rate in 1973-78 was about 20 fish per acre. Evaluation studies such as water quality determinations, fish population sampling with gill nets, electrofishing, rotenone, food habits, creel surveys, a mail-in survey, and age and growth surveys were conducted in 1973-78 to determine the success of stockings in those years. The purposes of stocking striped bass in Herrington Lake were to utilize the open-water habitat that most of the lake represented, utilize the

STOCKING AND INTRODUCTIONS

80-001758 CONTINUED abundant gizzard and threadfin shad populations, and develop a put-grow-take fishery that would, in part, provide trophy-size fish to Kentucky anglers. The first two objectives were accomplished, and part of the third goal was achieved by providing trophy-size fish. A striped bass fishery did develop, but only during the summer months, if one describes the fishery as that in which an angler fishing for striped bass could expect to catch one. The best harvest was 0.25 pound per acre in 1978. A one percent increase in the sport fish harvest was accomplished in 1975 due to the addition of striped bass to the creel. Two limiting factors, a lack of fishing interest for striped bass and a high natural mortality period for adult striped bass in late summer, prevented a fishery from developing. Future striped bass stockings after 1978 were not recommended. A hybrid between the striped bass and white bass was recommended for annual stocking, instead. Management objectives of developing a put-grow-take fishery where at least one pound of fish is harvested per acre and an increase of the sport fish harvest by at least ten percent were not accomplished by stocking striped bass. These objectives, however, are expected to be achieved by introductions of the hybrid.

80-001759 Henry, F. D., Jr. THE INTRODUCTION OF SOUTHEASTERN BLUEGILL, *LEPOMIS MACROCHIRUS PURPURESCENS*, INTO LAKE PERRIS, CALIFORNIA, WITH NOTES ON THE GROWTH OF THE INITAL YEAR CLASS. *Calif. Fish* Game 66(1):62-64. Jan. 1980. SFA 25(2)
[Calif. Dep. Fish Game, Operations Res. Br., 2201 Garden Rd., Monterey 93940]

80-001760 Lee, D. P. 1974-76 TAGGING STUDIES AT FRESHWATER LAGOON, HUMBOLDT COUNTY. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-3. 9p. Feb. 1980. SFA 25(2)
Angler harvest of catchable-sized trout released in Freshwater Lagoon was evaluated in 1974 and 1975 using $5.00 reward tags. Anglers returned 68% of the tags from the September 1974 release but only 20%, 20%, and 26% of the tags from the May, June, and July 1975 releases, respectively. A Chi-square test showed angler returns of tags from the 1974 fall release to be significantly greater than from the combined 1975 spring and early summer releases, but no significant difference existed among the spring and early summer releases. Angler returns of Whitney strain rainbow catchables and Eagle Lake trout x Coleman strain rainbow catchable hybrids were compared using nonreward tags in 1976. No significant difference was found in the overall return rate of these two groups. Recommendations for management of Freshwater Lagoon are also presented.

80-001761 Reisenbichler, R. R. and R. J. Hartmann, Jr. EFFECT OF NUMBER OF MARKED FISH AND YEARS OF REPETITION ON PRECISION IN STUDIES OF CONTRIBUTION TO A FISHERY. *Can. J. Fish. Aquatic Sci.* 37(4):576-582. Apr. 1980. SFA 25(2)
[U.S. FWS, P.O. Box 667, Red Bluff, CA 96080]

80-001762 Rogers, R. D. HARVEST OF FOUR STRAINS OF RAINBOW TROUT IN JACKSON MEADOWS RESERVOIR, CALIFORNIA. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-2. 19p. Feb. 1980. SFA 25(2)
Four strains of rainbow trout were fin clipped and stocked in Jackson Meadows Reservoir, Sierra and Nevada counties, in 1973 to test their relative contributions to the sport fishery. Strains were as follows: (1)

STOCKING AND INTRODUCTIONS

80-001762 CONTINUED rainbow-Shasta, *Salmo gairdneri*, (ii) rainbow-Coleman, *S. gairdneri*, (iii) rainbow-Kamloops, *S. gairdneri*, and (iv) rainbow-Kamloops x Lahontan cutthroat, *Salmo clarki henshawi*. The domestic Shasta and Coleman strains, stocked as fingerlings, had negligible returns and a high cost to the anglers' creel. The progeny of wild parents, Kamloops and the hybrid Kamloops x Lahontan cutthroat trout, were stocked at subcatchable size and had satisfactory returns. Kamloops performed best, having the highest catch rate and lowest cost to the anglers' creel. Superior performance of Kamloops was attributed to its larger size at the time of stocking. Most of the marked fish were caught during the spring of their second year in the lake, with boat anglers taking more and larger fish than shore anglers.

80-001763 Scarnecchia, D. L. and H. H. Wagner. CONTRIBUTION OF WILD AND HATCHERY-REARED COHO SALMON, *ONCORHYNCHUS KISUTCH*, TO THE OREGON OCEAN SPORT FISHERY. *NOAA Fish. Bull.* 77(3):617-623. July 1979. SFA 25(2)

[Colo. Coop. Fish. Res. Unit, Colo. State Univ., Fort Collins 80523] Eight scale characters of known hatchery and wild coho salmon, *Oncorhynchus kisutch*, were compared, and a linear discriminant fuction was used to determine whether hatchery and wild adult coho salmon could be reliably separated on the basis of scale characteristics. Attempted separation was based upon known differences in rearing environments of hatchery and wild juvenile coho salmon and upon hatchery smolts being larger than wild smolts. Identifications were correct for 82% of the hatchery fish and 89% of the wild fish. Based on analysis of scales from adult coho salmon of unknown origin (hatchery or wild) and the estimated catch of marked, hatchery-reared coho salmon taken by the Oregon sport fishery, we concluded that 75% of the fish caught in the ocean along the Oregon coast from mid-June to mid-September 1977 had been released as smolts from hatcheries. Percentages of hatchery fish in the catch ranged from 85 near the mouth of the Columbia River to 61 at Winchester Bay on the central Oregon coast. Fisheries along the south and central Oregon coast may have had access to higher percentages of wild coho salmon after mid-August than prior to this time, probably because wild fish from coastal streams remained near these ports, whereas most fish destined for Columbia River hatcheries had already migrated northward.

80-001764 Schneider, J. C. SURVIVAL, GROWTH, AND VULNERABILITY TO ANGLING OF WALLEYES STOCKED AS FINGERLINGS IN A SMALL LAKE WITH YELLOW PERCH AND MINNOWS. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1875. 20p. 27 Dec. 1979. SFA 25(2)

[Inst. Fish. Res., Mus. Annex, Ann Arbor, MI 48109] An experimental fish community comprised of fathead minnows, yellow perch, and walleyes was established in Jewett Lake. Fingerling walleyes about 150 mm long were stocked at the rate of 62 per hectare each fall for three consecutive years once the other species were established. Abundance, survival, growth, and food habits were monitored up through the fourth year. The fish community developed about as predicted from earlier studies. A large population of minnows was replaced by large, balanced populations of yellow perch and walleye. By the fourth year, survival of the three walleye plantings ranged from 0.071 to 0.706, depending at planting time on length of planted fingerling, abundance of food of the appropriate size, and density of older walleyes in the lake. Walleye mortality was highest during the first year in the lake (especially in the first month), and low in subsequent years. Test anglers found the walleyes and yellow perch fairly easy to catch. This type of fish community has good potential for fisheries management.

FISHING GEAR AND TECHNIQUES

80-001765 Beene, E. L. and A. M. Landry, Jr. THE ROLLER-NET: A NEW MARINE SAMPLING GEAR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:517-519. 1978[1979]. SFA 25(2)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843] The roller-net, a new fisheries sampling gear incorporating features common to the pushnet and bag seine, is described. The roller-net is compared with nearshore gear types, including pushnet, bag seine, and minnow seine, in beachfront, grassbed, barren sand-shell, and soft organic substrates. The roller-net is effective in sampling nekton from grassbed and barren sand-shell substrates, but ineffective in characterizing beachfront and soft organic substrates.

80-001766 Colton, J. B., Jr.; J. R. Green; R. R. Byron and J. L. Frisella. BONGO NET RETENTION RATES AS EFFECTED BY TOWING SPEED AND MESH SIZE. *Can. J. Fish. Aquatic Sci.* 37(4):606-623. Apr. 1980. SFA 25(2)
[Narragansett Lab., Narragansett, RI 02882]

80-001767 Elder, J. A.; J. W. Icanberry; D. J. Smith; D. G. Henriet and C. E. Steitz. ASSESSMENT OF A LARGE-CAPACITY FISH PUMP FOR SAMPLING ICHTHYOPLANKTON FOR POWER-PLANT ENTRAINMENT STUDIES. *Calif. Coop. Oceanic Fish. Invest.* 20:143-145. Oct. 1979. SFA 25(2)
[BioSystems Analysis, Inc., 1455 Airport Blvd., San Jose, CA 95110]

80-001768 Imai, T. [BASIC STUDIES ON THE PLANE NET SET INTO THE FLOWING WATER--IV. COMPARATIVE STUDY OF HYDRO-DYNAMICAL RESISTANCE ON KNOTTED AND KNOTLESS NETTINGS]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1277-1282. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Gear, Fac. Fish., Kagoshima Univ., Kagoshima, Japan]

80-001769 Kawamura, G. [FUNDAMENTAL STUDY ON APPLICATION OF THE VISION OF SPOTTED MACKEREL, *PNEUMATOPHORUS TAPEINOCEPHALUS* (BLEEKER), TO ANGLING TECHNIQUES--VII. MOVEMENTS OF FISH SCHOOL ATTRACTED TO FISH LAMP OBSERVED BY FISH FINDER.] *Bull. Jpn. Soc. Sci. Fish.* 45(11):1355-1358. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Technol. Fac. Fish., Kagoshima Univ., Kagoshima, 890 Japan]

80-001770 Laarman, P. W. and J. R. Ryckman. SIZE SELECTIVITY OF TRAP NETS FOR EIGHT SPECIES OF FISH. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1880. 16p. 25 Jan. 1980. SFA 25(2)
[Mich. Dep. Nat. Resour., East Lansing] Size selectivity of trap nets was determined from the ratio of recaptured fish of various lengths to the number of marked fish in the population. The nets operated in Manistee Lake (348 ha) from mid-September to mid-October (1974-1978) were size selective for six of eight species of fish. In general, nets were selective for the larger sizes of bluegills, pumpkinseeds, rock bass, black crappie, and yellow perch. Walleyes about 55 cm long and larger were more catchable than smaller sizes. Significant size selectivity was not evident for smallmouth bass and white suckers.

80-001771 Lancraft, T. M. and B. H. Robison. EVIDENCE OF POSTCAPTURE INGESTION BY MIDWATER FISHES IN TRAWL NETS. *NOAA Fish. Bull.* 77(3):713-715. July 1979. SFA 25(2)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

FISHING GEAR AND TECHNIQUES

80-001772 Maciolek, J. A. and A. S. Timbol. ELECTROSHOCKING IN TROPICAL INSULAR STREAMS. *Prog. Fish-Cult.* 42(1): 57-58. Jan. 1980. SFA 25(2)
[NMFS, Bldg. 204, Naval Support Activity, Seattle, WA 98115]

80-001773 Perry, W. G. SLAT TRAP EFFICIENCY AS AFFECTED BY DESIGN. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:666-671. 1978[1979]. SFA 25(2)
[La. Dep. Wildl. Fish., Grand Chenier 70643] This study contained 12 treatments consisting of 6 different trap designs; 6 were baited and 6 were not. A total of 2,770 catfish, blue (*Ictalurus furcatus*) and channel (*I. punctatus*) combined, weighing 984.0 kg was captured. Slat traps were highly selective for channel catfish. The highest individual catch was 40 kg by trap type E, a trap with 3.2 cm slat spacings on the rear portion of the sides and end. The sides around the front throats were solid. Highest total catch per trap day was in trap type F (2.5 cm spacing, closed sides around throats). Type F yielded 1.7 kg of channel catfish and 0.7 kg blue catfish per trap day. No statistical difference for total weight harvested was found when the 2 trap types B and E were compared to trap types C and F ($P>.05$). A highly significant difference existed between the catch of these traps for both species of catfish combined that were of a commercial size ($P<.01$). Trap type B had 3.2 cm slat spacings and types C and F each had 2.5 cm spacings. Type F, like type E, had solid sides around the front throats.

80-001774 Seawell, W. M. and K. W. Hevel. COMPARISON OF TWO METHODS OF RECAPTURING MARKED FISH FOR ESTIMATING BLACK BASS POPULATIONS IN A RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:437-445. 1978[1979]. SFA 25(2)
[TVA, Norris, TN 37828] The population of largemouth bass (*Micropterus salmoides*) in 2314-ha Melton Hill Reservoir, TN, was estimated by 2 mark and recapture methods. Shoreline electrofishing was used to capture fish for marking, while shoreline electrofishing and a bass fishing tournament were used to obtain recaptures. Both methods yielded estimates of the same magnitude; however, slightly different size selectivities were found with the 2 recapture methods. Species selectivity of shoreline electrofishing and the bass tournament are also compared. The population strucutre of the black bass population in Melton Hill Reservoir is examined and possible causes for this structure are presented.

80-001775 Shimamura, T. and H. Soeda. [THE CHANGE OF CATCH OF TUNA LONGLINE DEPENDS ON SOAKING TIME AND SOAKING TIME ZONE OF GEAR]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1081-1084. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Coll. Agric. Vet. Med., Nihon Univ., 34-1, Shimouma, Setagaya-ku, Tokyo 154, Japan]

80-001776 Shinomiya, H. and M. Miyauchi. [OPTIMUM SPEED OF TUNA LONG LINE FISHING BOAT FOR DESIGNING]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1075-1080. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Fac. Agric. Vet., Nihon Univ., Setagaya-ku, Tokyo 154, Japan]

80-001777 Smith, P. E. and S. L. Richardson. STANDARD TECHNIQUES FOR PELAGIC FISH EGG AND LARVA SURVEYS. *FAO Fish. Tech. Pap.* No. 175. 100p. 1977. SFA 25(2)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

FISHING GEAR AND TECHNIQUES

80-001778 Timmons, T. J.; W. L. Shelton and W. D. Davies. SAMPLING OF RESERVOIR FISH POPULATIONS WITH ROTENONE IN LITTORAL AREAS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:474-485. 1978[1979]. SFA 25(2)

[Ala. Coop. Fish. Res. Unit, Auburn Univ., Auburn 36830] A method of sampling fish populations in the littoral area of reservoirs was developed to estimate the number and standing stock of young-of-the-year (YOY) and adult fishes in West Point Reservoir, Alabama-Georgia. A surface area of 0.01 ha was surrounded with a net (30.5 m x 2.7 m) and the fish were poisoned with rotenone. The sample sites were chosen randomly by using a grid system. The average monthly standing stock (kg/ha) from April to September 1977 ranged from 74.2 in September to 126.1 in June. The weekly samples yielded data that enabled us to estimate the reproductive success and time of spawning for many species. We determined a weekly mortality rate of YOY largemouth bass (*Micropterus salmoides*) and could assess the availability of prey species. By using this method we sampled a wider variety of habitats and collected more species (34) than were taken in large rotenone samples from coves (29) or by electrofishing (28), and provided a reasonable estimate of standing stock in shallow littoral areas. The technique required only 2 people and little specialized equipment.

FERTILIZATION OF SOIL AND WATER

80-001779 Boyd, C. E.; J. W. Preacher and L. Justice. HARDNESS, ALKALINITY, pH AND POND FERTILIZATION. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:605-611. 1978[1979]. SFA 25(2)

[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830] Many ponds in the southeastern United States have waters with less than 20 mg/l total alkalinity and should be limed to insure good response to inorganic fertilization. Water analysis is the only technique for determining if a pond needs liming, and the liming rate can best be estimated from a lime requirement determination of the bottom mud. In some waters total alkalinity may be high, but total hardness low. Such waters frequently develop dangerously high pH when fertilized. Alum rather than acid forming fertilizers should be used as emergency treatment to prevent fish kills during periods of high pH. Data on alkalinity and hardness are therefore needed when making fertilizer recommendations for individual ponds. Sufficiently accurate water analyses may be made with water analysis kits, provided reasonable care is exercised.

80-001780 El Samra, M. I. and J. Olah. SIGNIFICANCE OF NITROGEN FIXATION IN FISH PONDS. *Aquaculture* 18(4):367-372. Dec. 1979. SFA 25(2)

[Inst. Oceanogr. Fish., Acad. Sci., Alexandria, Egypt] The magnitude of nitrogen fixation in an inorganic fertilized and cereal fed system (fish pond) was measured by an in situ application of the acetylene reduction method. The effects of inorganic fertilization were intensively examined. In comparison with natural lakes, the fish ponds exhibited a relatively low fixation rate. The midday nitrogen fixation rate was usually less than 30 µg at $N/m^2/h$. The total income was equal to 5.7 kg N/ha or 0.575 g N/m^2 for the growing season. Fish-induced bioperturbation and nitrogen fertilization, in the form of inorganic and organic fertilizers and foods, are considered to be the major regulatory factors in nitrogen fixation. major regulatory factors in nitrogen fixation.

80-001781 Helfrich, L. A. and L. A. Nielsen. SHOULD FISH PONDS BE FERTILIZED? THE LOW-DOWN ON THIS SHOULD SURPRISE YOU. *Va. Wildl.* 41(1):16-17. Jan. 1980. SFA 25(2)

[Cheatham Hall, VPI & SU, Blacksburg, VA 24061]

MATHEMATICS, STATISTICAL METHODS, AND MODELING

80-001782 Buyakas, V. I.; A. A. Darkov; D. V. Radakov and Yu. V. Chekalayev. A MATHEMATICAL MODEL OF THE MOVEMENT OF A FISH SCHOOL. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):822-831. 1978. SFA 25(2)
[A. N. Severtsov Inst. Evol. Morphol. Anim. Ecol., USSR Acad. Sci., Moscow, USSR] A mathematical model of the movement of a fish school was constructed, allowing for the main features of schooling behavior. The results of computer numerical integrations are given. The possibility of using the mathematical model to predict the behavior of fishes under particular environmental conditions is discussed.

80-001783 Cammen, L. M. ESTIMATION OF BIOLOGICAL POWER FUNCTIONS FROM GROUP MEASUREMENTS. *Can. J. Fish. Aquatic Sci.* 37(4):716-719. Apr. 1980. SFA 25(2)
[Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada]

80-001784 Ebert, T. A. ESTIMATING PARAMETERS IN A FLEXIBLE GROWTH EQUATION, THE RICHARDS FUNCTION. *Can. J. Fish. Aquatic Sci.* 37(4):687-692. Apr. 1980. SFA 25(2)
[Dep. Biol., San Diego State Univ., San Diego, CA 92182]

80-001785 Thompson, R. W. and D. A. Cauley. POPULATION BALANCE MODEL FOR FISH POPULATION DYNAMICS. *J. Theor. Biol.* 81(2):289-307. 21 Nov. 1979. SFA 25(2)
[Dep. Chem. Eng., Worcester Polytech. Inst., Worcester, MA 01609] A population balance model of fish population dynamics for batch systems was developed. A growth rate expression was introduced and coupled with the population balance. Solutions of the model provide predictions of such fish size distribution characteristics as average size, standard deviation and coefficient of variation. A growth diffusivity mechanism was found to be inapplicable to systems where a terminal size is reached. A study of the two parameter growth rate expression was conducted, illustrating that conditions conducive to high growth rates also resulted in broadening of size distributions. The model was compared to data found in the literature to demonstrate its predictive capabilities.

LAKE MANAGEMENT AND RESEARCH

80-001786 Bandow, F. EFFECTS OF WINTERKILL AND CHEMICAL ERADICATION OF FISH ON A LAKE ECOSYSTEM. *Minn. Dep. Nat. Resour. Sect. Fish. Invest. Rep.* No. 369. 40p. Apr. 1980. SFA 25(2)
[Rt. 2, Box 105, Waterville, MN 56096] Chemical, physical, and biological characteristics of a shallow lake dominated by black bullheads were to be compared before and after reclamation with rotenone. The pretreatment phase was shortened to one summer by a winterkill in 1975 that nearly eliminated the bullhead population. The surviving bullhead population was treated with rotenone in the fall of 1975. In the three summers following the winterkill there was a substantial decline in chlorophyll *a* concentrations and a more moderate decline in primary production. Secchi disc visibility correspondingly increased and submerged macrophytes which initially were nearly absent at depths over 5 feet proliferated to occupy nearly the entire lake bottom. During the final summer the chlorophyll concentration reached a relatively low peak in early July and then declined despite relatively high nutrient concentrations. The postwinterkill years were characterized by increased numbers of large filter feeding zooplankters presumably as a result of reduced bullhead predation and to which the postwinterkill decline in

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80-001786 CONTINUED chlorophyll is largely attributed. The plankton Crustacea were substantially reduced by the rotenone and calanoid copepods, which dominated at the time of the treatment, never regained former abundance during the following two summers when, instead, *Daphnia* dominated the community. The chemical treatment may also have caused a change in the species composition of rotifers and a temporary reduction in some of the major benthic invertebrates.

80-001787 Carlander, K. D. WATER HYACINTH AND OVERFISHING PROBLEMS ON AN INDONESIAN LAKE. *Proc. Iowa Acad. Sci.* 87(1):20-22. Mar. 1980. Abstract only. SFA 25(2)

[Dep. Anim. Ecol., Iowa State Univ., Ames] Water hyacinths, *Eichhornia crassipes*, and floating grass islands have been a serious problem for more than 50 years on Rawa Pening, a 2500-ha lake in central Java. Fish harvest increased with control of the plants in 1932-42 and 1951-56 but decreased as plants again increased in abundance. Control measures since 1962 have maintained open water but have not eliminated the problem. *Hydrilla verticillata* becomes abundant as the surface is cleared of water hyacinths. *Hydrilla* shelters *Macrobrachium* shrimp and other aquatic organisms, important to fish, and also is harvested for pig food. Annual fish yield dropped from about 530 kg/ha in 1972 to 178 in 1975 and to 18 kg/ha in 1978. Most species of fish averaged smaller in 1978 than in 1975. Overfishing is indicated, but the low catches are probably the result of other factors also.

80-001788 Francis, G. R.; J. J. Magnuson; H. A. Regier and D. R. Talhelm, eds. REHABILITATING GREAT LAKES ECOSYSTEMS. *Great Lakes Fish. Comm. Tech. Rep.* No. 37. 99p. Dec. 1979. SFA 25(2)

[Fac. Environ. Stud., Univ. Waterloo, Waterloo, ON N2L 3G1, Canada]

80-001789 Klein, W. D. KOKANEE IN PARVIN LAKE, COLORADO, 1972-1977. *Colo. Div. Wildl. Fish. Res. Sect. Spec. Rep.* No. 47. vi + 19p. Dec. 1979. SFA 25(2)

[538 S. Taft Hill Rd., Fort Collins, CO 80521] Kokanee were studied in Parvin Lake, a small, eutrophic lake in northern Colorado, to learn about the best ways to manage populations in this kind of environment. The study began with an experimental plant of 30,000 Flathead Lake-strain kokanee fry on May 10, 1972. Observations continued through the life cycle (age-group V+) of the salmon. Rainbow and brown trout were present in substantial numbers throughout the study. Fishing from 1972 to 1975 was restricted to artificial lures only and boats and other floating devices were prohibited. Overlaps in food habits and spatial distribution of kokanee and trout indicated that a potential existed for interactions between them that could be detrimental to the trout; however, conflicts would probably not develop at modest fish population levels. Significant direct or indirect conflicts between trout and kokanee were not documented. A pronounced outmigration of immature kokanee from the lake via the surface outlet occurred in July-August 1972 (age 0+ fish) and in May-June 1973. This egress was capable of reducing the lake population by 12.5 percent, with 8 percent assignable to the 1972 kokanee migrants. The kokanee catch consisted of 561 fish, or 1.87 percent of the original plant. Restrictions against bait and boat use probably severely restricted the catch. Angling appeared less efficient with each succeeding year from 1974 to 1976. Kokanee were most vulnerable to angling in August, and angler harvest in 1974 and 1975 was heavily biased toward mature fish. Estimates of kokanee biomass as well as estimates of the spawning populations and their sex-ratios were obtained. Kokanee could be used as a major or minor game fish at Parvin Lake, but any future use should entail late-summer or

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80-001789 CONTINUED fall fingerling plants. Also, other lakes that now receive kokanee fry plants and offer summer availability to a surface spillway should be considered for late-summer or fall fingerling plants.

80-001790 Lawrie, A. H. THE FISH COMMUNITY OF LAKE SUPERIOR. *J. Great Lakes Res.* 4(3/4):513-549. 1978. SFA 25(2)

[Res. Sect., Fish. Br., Ontario Minist. Nat. Resour., Box 50, Maple, ON LOJ 1E0, Canada] Lake trout, lake whitefish, and their relatives characterize the fish community of oligotrophic Lake Superior. That community has been substantially altered by the direct and indirect effects of man's activities, generally in the direction of reduced diversity and depletion of many fish stocks. Long-continued heavy fishing, predation by and competition from invading exotic species, and environmental degradation have all played a role as have efforts to rehabilitate the community by introducing hatchery-reared fish of desired species. Community responses to these influences have been complex and although some are obvious and can be quantitatively modelled others reflect subtler, interactive responses to primary changes in abundance and size composition of various components of the community. Among the stresses whose roles remain to be clearly defined are the anthropogenic contaminants now know to occur, if only in small concentrations, in virtually all species. Although their impact on the welfare of individual fish stocks cannot be precisely defined at the moment their presence at all is profoundly disturbing.

80-001791 O"Neal, R. P. THE POTENTIAL FOR COMMERCIAL HARVEST OF UNDERUTILIZED FISH IN INLAND LAKES IN MICHIGAN. *M.S. thesis, Mich. State Univ.* 126p. 1978. From Masters Abstr. 17(4):241. Dec. 1979. SFA 25(2)

The primary species of underutilized fish in inland lakes in Michigan are carp (*Cyrpinus carpio*), white sucker (*Catostomus commersoni*), yellow bullhead (*Ictalurus natalis*), brown bullhead (*Ictalurus nebulosus*) and black bullhead (*Ictalurus melas*). White sucker is the primary commercial species in 54.9%, bullhead in 24.9% and carp in 20.2% of the designated inland waters of the state. Some 116,694 acres may be available for the commercial harvest of underutilized fish. Total acreage for each region of the state is: Region I-37,277 acres; Region II-63,868 acres; and Region III-15,549 acres. Based on preliminary biomass estimates, these waters support 7,996,425 pounds of rough fish, (Region I-1,453,803 pounds; Region II-4,023,684 pounds; and Region III-2,518,938 pounds). Other information discussed includes methods of harvest used in inland lakes, rough fish programs in other states, a review of the literature on rough fish management and some important aspects concerning this management.

80-001792 Schneider, J. C. and R. N. Lockwood. EFFECTS OF REGULATIONS ON THE FISHERIES OF MICHIGAN LAKES, 1946-65. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1872. 247p. 20 Nov. 1979. SFA 25(2)

[Inst. Fish. Res., Mus. Annex, Ann Arbor, MI 48109] Creel census statistics and related data, collected 1946-65, are presented for 22 Michigan lakes where sport fishing regulations were tested. The main objective was to determine if increased fishing opportunity could be provided without damaging the populations or their fisheries. For panfish, removal of the closed spring season, removal of the 6-inch size limit, and removal of creel limits were tested. For game fish, length of the closed spring season, both high and low size limits, and a ban on northern pike spearing were tested. For rainbow trout stocked in lakes, spring and winter fishing seasons were tested. Most of the lakes were of the largemouth bass-bluegill type. It was difficult to accurately discern the effects of the fishing regulations because of imprecise statistics, a large increase in fishing pressure following World

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80-001792 CONTINUED War II, a widespread increase in fishing for bass coupled with a decrease in fishing for panfish during the 1950's, irregular recruitment, and other uncontrolled events. It is clear that, in general, no dramatic changes in fisheries or populations resulted; however, some experienced a gradual deterioration which may or may not be linked to the tests. It is recommended that game fish size limits and closed seasons be retained on most lakes in Michigan. Pumpkinseeds, rock bass, black crappie, and in some lakes largemouth bass and smallmouth bass, were especially vulnerable to spring fishing. Size limits typically had strong effects on the catches of bass and northern pike, as predicted by Latta (1972, 1974, 1975).

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-001793 Bayha, K. INSTREAM FLOW METHODOLOGIES FOR REGIONAL AND NATIONAL ASSESSMENTS. *U.S. Fish Wildl. Serv.* FWS/OBS-78/61. xii + 90p. Dec. 1978. SFA 25(2)
[U.S. FWS, 2625 Redwing Rd., Fort Collins, CO 80526]

80-001794 Berg, R. SPOONBILL. *Mont. Outdoors* 11(3):11-13, 21-22. Mar.-Apr. 1980. SFA 25(2)

80-001795 Bowers, W.; B. Hosford; A. Oakley and C. Bond. WILDLIFE HABITATS IN MANAGED RANGELANDS--THE GREAT BASIN OF SOUTHEASTERN OREGON. NATIVE TROUT. *U.S. For. Serv. Pac. Northwest For. Range Exp. Stn. Gen. Tech. Rep.* PNW-84. 16p. 1979. Available from Pac. Northwest For. Range Exp. Stn., 809 N.E. 6th Ave., Portland, OR 97232. SFA 25(2)

80-001796 Dorfman, D. SENEGAL RIVER, AFRICA: FISHES OR DAMS? *Underwater Nat.* 12(2):4-6. 1980. SFA 25(2)
[Monmouth Coll., Long Branch, NJ]

80-001797 Dumas, J. LES SAUMONS (*SALMO SALAR* L.) ADULTES DE LA NIVELLE (PYRENEES-ATLANTIQUES) EN 1977. DEBUT DE RESTAURATION AVEC DES SMOLTS D'ELEVAGE D'ORIGINE ECOSSAISE. [THE 1977 SALMON (*SALMO SALAR* L.) RUN IN THE RIVER NIVELLE (PYRÉNÉNEES-ATLANTIQUES). FIRST SUCCESSFUL ATTEMPTS AT REHABILITATION WITH STOCKING OF HATCHERY-REARED SMOLTS OF SCOTISH ORIGIN.] *Ann. Limnol.* 15(2):223-238. 1979. In French with English summ. SFA 25(2)
[I.N.R.A., B.P. 3, Sainte-Pé-sur-Nivelle, 64310 Ascain, France] A sample of adult salmon from the river Nivelle shows that the population is being restored and that the contribution of hatchery-reared salmon is very important (58 percent). Grilse make up the bulk of the sample (91 percent of wild fish and all those of hatchery origin). «Hatchery grilse» were obtained from ova imported from a remote river in Northern Scotland; capture rate in the river of hatchery salmon released as 2-years-old smolts is 12 times better than that of 1-year-old smolts (1.42 percent vs. 0.12 percent). Whether wild or hatchery-reared, grilse of the river Nivelle enjoy one of the best growth rates in the Atlantic basin (67.7 cm). Sex-ratios of 1.5 to 1.7/1 in favor of females are very high. Releases of hatchery-reared smolts of foreign origin have given a good start to the process of rehabilitation of the Nivelle salmon stock which had virtually disappeared.

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-001798 Graham, K. PADDLEFISH: GOOD NEW AND BAD NEWS... *Mo. Conserv.* 41(3):20-22. Mar. 1980. SFA 25(2)
[Mo. Dep. Conserv., Columbia]

80-001799 Graham, P. J.; R. F. Penkal and L. Peterman. AQUATIC STUDIES OF THE YELLOWSTONE RIVER. *U.S. Dep. Interior Bur. Reclam.* REC-ERC-79-8. vi + 80p. July 1979. SFA 25(2)
[Appl. Sci. Br., Div. Res., Eng. Res. Cent., Denver, CO] This study is a continuation of earlier lower Yellowstone River studies to determine the effects of streamflow alterations on various fish populations. These studies are part of a large-scale effort by the Bureau to determine the availability of water from the Yellowstone River and its tributaries for use in developing coal resources in southeastern Montana. Since fish migration is related to spawning, feeding, over-wintering, and other biological activities, any diversion structure which would impede movement may restrict the biological activities needed for continued survival or abundance of a species. Data required for this determination are: (1) effects of a dam upon movement; (2) changes, if any, in biological activities of the species both above and below the diversion; and (3) if movement is restricted, how the population is affected. Walleye and sauger were studied in this phase of the project because they are important game fish and have a wide range. Results of data collected by personnel of the Montana Department of Fish and Game on the life history and distribution of these two species are documented. The unique physical and hydraulic characteristics of the river necessitated adaptation of equipment and sampling techniques to accommodate these conditions. The problems of electrofishing a large river like the Yellowstone are discussed and the electrofishing boat used is described in detail.

80-001800 Kubicek, P. F. EVALUATION OF THE EFFECTS OF DIFFERENT STREAMFLOW RELEASES ON TROUT HABITAT BELOW HYDROELECTRIC DIVERSION DAMS: TWO CASE STUDIES. *Cal-Neva Wildl.* 1979:55-68. 1979. SFA 25(2)
[Pac. Gas Elec. Co., San Ramon, CA] Studies designed to evaluate the effects of different streamflow releases on trout habitat were conducted in the North Fork Feather River between Rock Creek Diversion Dam and Powerhouse and in Hat Creek between Hat Creek No. 2 Diversion Dam and Powerhouse. Physical habitat characteristics (depth, velocity, and substrate) were measured under select streamflow releases along transects at representative stations in each stream. Relative values of three important trout habitat parameters (resting microhabitat, food producing habitat, and spawning habitat) were calculated for each measuring point under each streamflow release through the use of weighting factors assigned to the measured habitat characteristics. The relationships between streamflow release and available resting microhabitat, food producing habitat, and spawning habitat for trout were derived and expressed quantitatively for each transect, station, and stream section. The resulting relationships, which showed considerable variation between stations and between habitat parameters, are discussed in relation to the Federal Energy Regulatory Commission licensing process for hydroelectric power projects.

80-001801 Lamb, B. L. and D. A. Sweetman, eds. GUIDELINES FOR PREPARING EXPERT TESTIMONY IN WATER MANAGEMENT DECISIONS RELATED TO INSTREAM FLOW ISSUES. *U.S. Fish Wildl. Serv.* FWS/OBS-79/37. iii + 32p. Sept. 1979. SFA 25(2)
[U.S. FWS, 2625 Redwing Rd., Fort Collins, CO 80526]

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-001802 Nelva, A.; H. Persat and D. Chessel. UNE NOUVELLE MÉTHODE D'ÉTUDE DES PEUPLEMENTS ICHTYOLOGIQUES DANS LES GRANDS COURS D'EAU PAR ÉCHANTILLONNAGE PONCTUEL D'ABONDANCE. [A NEW METHOD FOR INVESTIGATING FISH POPULATIONS IN LARGE STREAMS BY MULTIPLE POINT ABUNDANCE SAMPLING.] *C.R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 289(16):1295-1298. Dec. 1979. SFA 25(2)

[Dep. Biol. Anim., Univ. Claude-Bernard, Lyon I, 43, boulevard du 11-novembre-1918, 69622 Villeurbanne Cedex, France] The usual methods of fishing cannot be applied to the study of the fish populations in large streams because of the size of these ecosystems. Our new method consists in collecting by electrofishing a great number of small-sized samples which are evenly distributed over the area investigated. The relative abundance of the species, the specific structure of the population and the relations between the species and their biotope can thus be determined.

80-001803 Robinson, J. W. THE MISSOURI RIVER FISHERY ... *Mo. Conserv.* 41(1):16-18. Jan. 1980. SFA 25(2)

[1110 College Ave., Fish & Game, Columbia, MO 65201]

80-001804 Sherwood, T.; D. Febinger and J. T. Windell. A HABITAT MANAGEMENT PLAN FOR THE ST. VRAIN WATERSHED BASED ON STREAM ORDER ANALYSIS. *J. Colo.-Wyo. Acad. Sci.* 12(1):13-14. Apr. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Colo., Boulder]

80-001805 Wassenberg, P. S.; S. Olive; J. L. Demott and C. B. Stalnaker. ELEMENTS IN NEGOTIATING STREAM FLOWS ASSOCIATED WITH FEDERAL PROJECTS. *U.S. Fish Wildl. Serv.* FWS/OBS-79/03. v + 41p. Aug. 1979. SFA 25(2)

[U.S. FWS, 2625 Redwing Rd., Fort Collins, CO 80526]

80-001806 Wishard, S. K. ROAK FISHING AND ITS PROBABLE EFFECTS ON THE CAPTURE FISHERY OF RIVER YAMUNA IN AGRA DISTRICT. *Indian J. Fish.* 23(1/2):213-231. 1976. SFA 25(2)

[Cent. Inland Fish. Res. Substn., Allahabad, India] The total annual yield of the economically important fishes of Yamuna in Agra is estimated from the catch statistics collected from 1960 to 1968. Monthly and annual fluctuations in catches, changes in fishing mortality, year-class strength, and mean lengths are presented and discussed in relation to the fishing methods, especially that of erecting barriers across the river, locally called 'Roak'. The catch by this method alone, constituting 54-88% of the total annual catch, is responsible for the declining trends in the major carp fishery of the area. Management measures that may be adopted to offer protection to the migrating potential spawners of major carps are discussed.

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

80-001807 Fong, S. DYNAMICS OF BASS-BLUEGILL POPULATIONS IN FARM PONDS. *Ph.D. dissertation, Auburn Univ.* 144p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2453. Dec. 1979. SFA 25(2)

The effects of stocking with fingerling fishes on the dynamics of bass, *Micropterus salmoides* (Lacepede) and bluegill, *Lepomis macrochirus* (Rafinesque) fish populations in farm ponds was investigated both experimentally and by analysis of historical data. Two computer simulation models were constructed utilizing the statistical analysis of these data. The first model deals mainly with effects of stocking. A stocking rate of 400 bass per hectare gave a higher yield of bass than the 250/ha which was suggested by Swingle. The second model studied the fluctuation of the population for an indefinite period of time. Simulation of this model shows

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

80-001807 CONTINUED that the bass stocking rate affects the yield of bass for many years but the bluegill population will be free from stocking effects three years after stocking. Given constant rates of exploitation, the bluegill population tends to stabilize while the bass population decreases through the years with the speed of descent dependent on the rate of exploitation of each of the species. The stochastic process of the bass-bluegill population was studied. Transition probability matrices under specific values of exploitation were simulated from the model. Information was proposed for improving the management of fish populations in farm ponds by use of Markov chain theory.

80-001808 McCaig, Robert S. EFFECT OF SEA-RUN ALEWIVES ON RAINBOW TROUT AND BROWN TROUT IN RECLAIMED PONDS. *Prog. Fish-Cult.* 42(1):59-63. Jan. 1980. SFA 25(2)
[Mass. Div. Fish. Wildl., Westboro 01581]

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH

80-001809 Heitman, J. F. A NEW APPROACH TO RESERVOIR FISHERIES MANAGEMENT. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):18. Jan.-Feb. 1980. SFA 25(2)
[Rt. 4, Box 168, Eufaula, OK 74432]

80-001810 Heitman, J. F. and M. J. Van Den Avyle. SPECIES COMPOSITION, CATCH RATES, AND IMPACT OF A COMMERCIAL FISHERY ON STRIPED BASS IN WATTS BAR AND CHICKAMAUGA RESERVOIRS, TENNESSEE. *Proc. Annu. Conf. Southeast. Fish Wildl. Agencies* 32:576-587. 1978[1979]. SFA 25(2)
[Lake Eufaula Fish. Manage. Prog., Rt. 4, Box 1238, Eufaula, OK 74432] Between March and October 1977, methods of local commercial fishermen were simulated to evaluate species composition, catch rates, and potential impact of the commercial fishery on striped bass (*Morone saxatilis*) in 2 Tennessee River mainstream impoundments. Estimated total commercial harvest rates during the sampling period were 26.6 kg/ha and 23.1 kg/ha in Watts Bar and Chickamauga Reservoirs. Because commercial fishing was concentrated in tailwater regions of both reservoirs, experimental catch rates and high estimated commercial harvest rates were probably not representative throughout each reservoir. Low catch rates of striped bass and other game fishes suggested that commercial netting had no negative influence on these species. It does appear, however, that the commercial fishery may be influencing rough fish species composition. Standing crops of buffalofish (*Ictiobus* spp.) have declined in recent years while carp (*Cyprinus carpio*) biomass has increased.

80-001811 Sreenivasan, A. FISH PRODUCTION AND FISH POPULATION CHANGES IN SOME SOUTH INDIAN RESERVOIRS. *Indian J. Fish.* 23(1/2):134-152. 1976. SFA 25(2)
[Hydrobiol. Res. Stn., Madras 10, India]

ESTUARY MANAGEMENT AND RESEARCH

80-001812 Balling, S. S.; T. Stoehr and V. H. Resh. THE EFFECTS OF MOSQUITO CONTROL RECIRCULATION DITCHES ON THE FISH COMMUNITY OF A SAN FRANCISCO BAY SALT MARSH. *Calif. Fish Game* 66(1):25-34. 1980. SFA 25(2)
[Div. Entomol. Parasitol., Univ. Calif., Berkeley 94720] Effects of mosquito control recirculation ditches on species composition, density, and size and age structure of pickleweed (*Salicornia virginica*) salt marsh

ESTUARY MANAGEMENT AND RESEARCH

80-001812 CONTINUED fish community were analyzed in Albrae Slough marsh near Fremont, Alameda Co., California. Collections from January through August 1978 revealed that 10 species occupy ditched areas but only 5 species unditched areas. In an August 1978 inventory, fish density was three times greater in ditched (11.0 fish/m^2) than unditched (3.7 fish/m^2) areas. Size and age structure of the dominant species, *Gambusia affinis*, indicated that the ditched area populations have a greater proportion of immatures than found in unditched areas. The high proportion of immatures in the ditched area and in a recolonizing population examined 4 weeks after inventory indicates differential immigration by immatures. Ditching may increase diversity and density through improved habitat accessibility for fish from other areas and a ditch design which allows water retention at low tide, providing refuge for fish and their food.

MARINE MANAGEMENT AND RESEARCH

80-001813 Rørvik, C. J. THE NORWEGIAN INDUSTRIAL TRAWL FISHERY IN THE NORTH SEA. *Fiskeridir. Skr. Ser. Havunders.* 17(1):19-27. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway] Linnear programming is used to demonstrate a way to maximise the total catch in a mixed fishery. Constraints are set by quotas, as well as requirements that the total catch should not be too unevenly distributed between areas and throughout the season. A practical application of this technique in fisheries management depends on a satisfactory prediction of the ratio of the quota-regulated species in the total catch before the season starts.

80-001814 Bakkala, R.; W. Hirschberger and K. King. THE GROUNDFISH RESOURCES OF THE EASTERN BERING SEA AND ALEUTIAN ISLANDS REGIONS. *Mar. Fish. Rev.* 41(11):1-24. Nov. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001815 Jerpi, D. A. BOSTON FISH PIER LANDINGS, 1978: A REVIEW. *Mar. Fish. Rev.* 41(10):29-34. Oct. 1979. SFA 25(2)
[NMFS, 10 Commonwealth Pier, Boston, MA 02210]

80-001816 Lopez, A. M.; D. B. McClellan; A. R. Bertolino and M. D. Lange. THE JAPANESE LONGLINE FISHERY IN THE GULF OF MEXICO, 1978. *Mar. Fish. Rev.* 41(10):23-28. Oct. 1979. SFA 25(2)
[NMFS, 75 Virginia Beach Dr., Miami, FL 33149]

80-001817 Okamoto, M.; T. Kuroki and T. Murai. [FUNDAMENTAL STUDIES ON THE ECOLOGY OF FISHES NEAR ARTIFICIAL REEFS--I. PREPARATORY OBSERVATION OF FISH AMOUNT]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1085-1090. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Jpn. Mar. Sci. Technol. Cent., Natsushima, Yokosuka, 237 Japan]

MISC. TECHNIQUES AND EQUIPMENT

80-001818 Foote, K. G. AVERAGING OF FISH TARGET STRENGTH FUNCTIONS. *J. Acoust. Soc. Am.* 67(2):504-515. Feb. 1980. SFA 25(2)
[Dep. Appl. Math., Univ. Bergen, 5014 Bergen, Norway] A general model for

MISC. TECHNIQUES AND EQUIPMENT

80-001818 CONTINUED averaging the acoustic target strength functions of fish is stated in calculable form. It accounts for the influences of the distribution of generally coupled spatial and orientation states of fish, geometric perspective, and beam patterns on observations of target strength. The model is developed and applied to observation of fish by directional, downward-looking sonars. A particular example is considered in which the sonar is represented by an ideal circular piston, the spatial distribution of fish is homogeneous, and the orientation distribution is spatially homogeneous and characterized by a uniformily distributed azimuthal variable and an independent, essentially normally distributed tilt angle variable. Averaged and averaged-squared backscattering cross sections are computed from high quality gadoid target strength functions measured at two ultrasonic frequencies. Results for a sonar half-beamwidth of 2.5 deg for three different realizations of the tilt angle distribution are expressed in the logarithmic domain and regressed linearly on fish length. The significance of species, frequency, and orientation distribution differences among the regressions is noted. Estimates of the mean ratio of averaged-squared backscattering cross section and squared-averaged backscattering cross section are presented.

80-001819 Huang, K. and C. S. Clay. BACKSCATTERING CROSS SECTIONS OF LIVE FISH: PDF AND ASPECT. *J. Acoust. Soc. Am.* 67(3):795-802. Mar. 1980. SFA 25(2)
[Gulf Res. Dev. Co., H.T.S.C., 11111 South Wilcrest, Houston, TX 77099]

80-001820 Lesh, E. W. A HEAD-OFF METHOD OF MEASURING CHINOOK AND COHO SALMON. *Calif. Fish Game* 66(1):59-62. Jan. 1980. SFA 25(2)
[Calif. Dep. Fish Game, 619 Second St., Eureka 95501]

80-001821 Sameoto, D. D. QUANTITATIVE MEASUREMENTS OF EUPHAUSIIDS USING A 120-kHz SOUNDER AND THEIR IN SITU ORIENTATION. *Can. J. Fish. Aquatic Sci.* 37(4):693-702. Apr. 1980. SFA 25(2)
[Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada]

REVIEWS, BIBLIOGRAPHIES, ETC.

80-001822 Nicholson, H. F. BIBLIOGRAPHY ON THE LIMNOLOGY AND FISHERIES OF CANADIAN FRESHWATERS. NO. 6. *Can. Dep. Fish. Oceans Tech. Rep.* No. 911. v + 10^5p. Jan. 1980. In English with French summ. SFA 25(2)
[Can. Cent. Inland Waters, 867 Lakeshore Rd., Burlington, ON L7R 4A6 Canada] This bibliography is the sixth of a continuing series and contains a further 500 references and the Canadian freshwater features to which they refer.

80-001823 Spivey, R. B. (Compiler). BIBLIOGRAPHY OF TECHNICAL REPORTS 1979. *Woods Hole Oceanogr. Inst. Tech. Rep.* WHOI-80-14. 12p. 1979. SFA 25(2)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

WATER USE AND CONSERVATION

80-001824 Koch, D. L. IMPACTS AND OPPORTUNITIES FOR AQUATIC BIOTA ASSOCIATED WITH ENERGY DEVELOPMENT IN NEVADA. *Cal-Neva Wildl.* 1979:74-77. 1979. SFA 25(2)

WATER USE AND CONSERVATION

80-001824 CONTINUED
[Desert Res. Inst., P.O. Box 60220, Reno, NV 89506] The impacts and opportunities for aquatic biota associated with energy developments in Nevada have been limited to this point in time but as environmental concerns of neighboring states such as California increase as well as more land areas for energy development become limited, Nevada will receive more pressure for energy developments. Projected electrical energy sales in the State of Nevada are from 7,623,731 MWH in 1975 to 18,518,390 MWH in the year 2000. If proper planning goes into energy developments in Nevada there are possible opportunities for aquatic biota such as: 1. utilization of waste heat sources to produce aquatic food organisms; 2. development and maintenance of aquaculture systems; and 3. creation of additional waterfowl habitats in arid climates.

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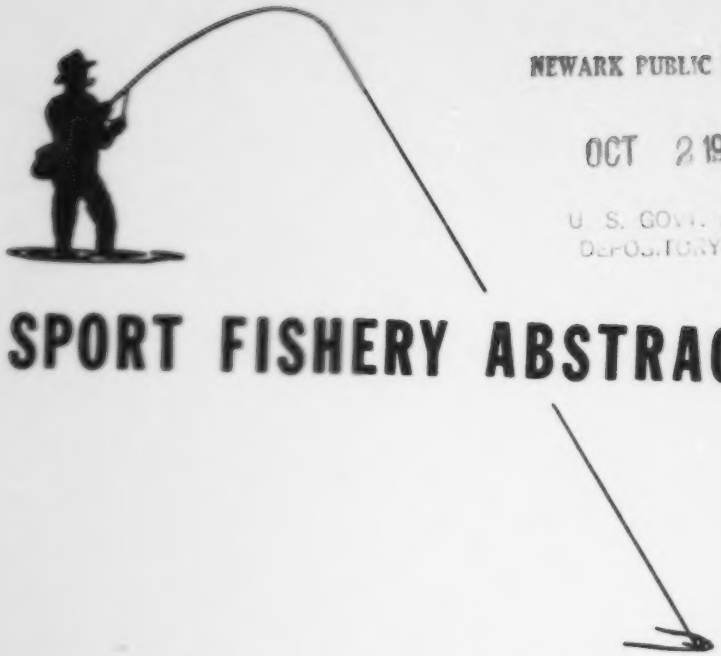

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Vol. 25, No. 3, 1980

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GENERAL FISH CULTURE

80-001825 Chien, Y.-H. and J. W. Avault, Jr. PRODUCTION OF CRAYFISH IN RICE FIELDS. *Prog. Fish-Cult.* 42(2):67-71. Apr. 1980. SFA 25(3)
[Sch. For. Wildl. Manage., La. State Univ., Baton Rouge 70803]

TROUT AND SALMON CULTURE

80-001826 Griffin, J. J. A SIMULATION MODEL OF A SALMONID REARING FACILITY. *Ph.D. dissertation, Univ. R.I.* 396p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5502. June 1980. SFA 25(3)

The efficient rearing of salmonid fishes has become important both for the replenishment of natural stocks for commercial and recreational catch and for direct market sales. High production facilities are currently operational in Scandinavia (Norway and Sweden), Canada and the U.S. (northeast, west and Alaska). Smaller hatcheries are operating in countries ranging from Great Britain, Iceland and Korea to Chile and New Zealand. Early interest centered on survival, first to smoltification and release size and later through sea return. The present cost of facilities and operations and the required rates of financial return to the investor emphasize the need for optimized operation. In this study, aspects of fish hatchery operations and optimization processes have been investigated in an effort to derive a useful analytical and predictive tool. A descriptive model, designed to parameterize critical biological, physical and financial elements of the rearing process over ranges experienced within the hatchery has been developed and applied in a general way to West Coast hatchery data and more specifically to the Quinebaug hatchery in Plainfield, Connecticut. This particular hatchery configuration was used as a base point for establishment of critical model elements as well as investigation of its present configuration and extension of that capability beyond current equipment and technique limits. In the model, growth is described as a function of ration, water temperature and organism weight and related to oxygen requirements, metabolic output, and resultant water requirements. Species specific mortality functions are derived. Stochastic elements relating to temperature, ration, growth and mortality are incorporated into the model. The methodology involves minimizing the costs of production of new protein by least-cost mixes of water temperature and ration, considering labor, capital, pumping and other costs. Internal cost elements are computed. Financial output (return on sales and return on investment), yearly operational matrices and appropriate plots are produced to allow ranking and relative quantification of operational strategies. In order to demonstrate that the parameters and relationships determined for the baseline operation are realistic and to demonstrate the usefulness of models for analyzing a hatchery, the elements of the simulation model were operated stochastically and compared to actual hatchery performance. A separate stochastic weather submodel was developed and applied to prediction of growth. The advantages of full and even plant loading, increased delivery weight, especially with heat addition and water recirculation, were evident for model runs. Oil and solar heating sources are compared. A stochastic unforeseen risk assessment methodology is suggested. The use of such a model in the planning and hatchery operations activity is discussed, and an example of on-line linear programming for real time use is provided.

WARMWATER CULTURE

80-001827 Anonymous. PROGRESS REPORT OF THE FRESHWATER AQUACULTURE CENTER. *Cent. Luzon State Univ. Freshwater Aquacult. Cent. Prog. Rep. Tech. Rep.* No. 13. v + 66p. 1978. SFA 25(3)
[Freshwater Aquacult. Cent., Cent. Luzon State Univ., Muñoz, Nueva Ecija 2320, Philippines] A collection of papers.--RS

80-001828 Broussard, M. C., Jr. THE EVALUATION OF FOUR STRAINS OF CHANNEL CATFISH, *ICTALURUS PUNCTATUS*, AND INTRASPECIFIC HYBRIDS UNDER AQUACULTURAL CONDITIONS. *Ph.D. dissertation, Tex. A&M Univ.* 75p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5478. June 1980. SFA 25(3)
[Channel catfish from two domestic strains and two wild strains, and intraspecific crosses between strains were evaluated under aquacultural conditions. Growth studies were conducted in tanks, cages, and communal ponds. Reproductive characters including spawning time, egg size, hatchability, and percent deformed fry were evaluated for each strain or cross. Correlations were also determined for reproductive characters and growth characters. Different strains of channel catfish had different peak spawning periods indicating possible genetic control. Hatchability was an extremely variable trait and no differences among strains or crosses could be domonstrated. Environmental factors may have overshadowed genetic factors affecting the frequency of deformed fry. No differences among strains or crosses could be deomonstrated for the percent of deformed fry. Deformed individuals had lower survival rates in ponds. The total weight of a spawn and the number of eggs/spawn were positively correlated to the weight of the female broodfish; egg weight was negatively correlated to the weight of the female broodfish. Egg weight was not correlated to hatchability or initial weight. However, initial weight was correlated to total weight during the first 60 days of growth in tanks. Domestic strains had superior growth rate compared to wild strains in ponds and cages. No heterosis for growth rates in ponds and cages could be demonstrated for crosses between domestic strains, or crosses between domestic and wild strains. There were no significant differences for percent survival in ponds and cages, and no consistent differences for dress-out percent. Initial variation for length and weight among strains or crosses were reduced during the growing season.

80-001829 Brown, E. E. BAIT FISH FARMING. *Riv. It. Piscic. Ittiop.* 15(1):7-10. Jan.-Feb.-Mar. 1980. In English and Italian. SFA 25(3)
[Dep. Agric. Econ., Univ. Ga., Athens 30602]

80-001830 Cremer, M. C. and R. O. Smitherman. FOOD HABITS AND GROWTH OF SILVER AND BIGHEAD CARP IN CAGES AND PONDS. *Aquaculture* 20(1):57-64. May 1980. SFA 25(3)
[Dep. Fish. Allied Aquacult., Auburn Univ. Agric. Exp. Stn., Auburn, AL 36830] Analysis of intestinal contents of silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) showed that silver carp consumed primarily phytoplankton while bighead carp consumed large quantities of zooplankton and detritus in addition to phytoplankton. The size of particles filtered by the bighead carp was larger (17-3,000 µm) than that filtered by silver carp (8-100 µm). Artificial feed was readily consumed by bighead carp but not by silver carp. No growth difference was indicated for silver carp in fertilized ponds and ponds receiving artificial feed. Growth of bighead carp increased substantially with the addition of artifical feed. Silver carp grew more rapidly in cages than bighead carp.

WARMWATER CULTURE (CONTINUED)

80-001831 Green, L. C. and J. R. Merrick. TROPICAL FRESHWATER FISH CULTURE: A COVERED POND IMPROVES PLANKTON AND FRY PRODUCTION. *Aquaculture* 19(4):389-394. Apr. 1980. SFA 25(3)
[28 Miva St., Cooray, Queensland 4563, Australia] Existing open planketon pond techniques employed in Australian warm-water fish culture are outlined. The development of the covered plankton pond is traced and details of materials used, management and production over an 18-month period provided. The advantages of covered ponds, improved design features for further work and the significance of techniques developed are briefly discussed.

80-001832 Horváth, L. USE OF A PROTEOLYTIC ENZYME TO IMPROVE INCUBATION OF EGGS OF THE EUROPEAN CATFISH. *Prog. Fish-Cult.* 42(2):110-111. Apr. 1980. SFA 25(3)
[Warmwater Fish Hatchery, Százhalombatta, P.O. Box 28, Hungary 2441]

80-001833 Lopez, J. V. and B. S. Ranoemihardjo. POLYCULTURE OF MILKFISH (*CHANOS CHANOS*) AND SHRIMP (*PENAEUS MONODON*) TO INCREASE PRODUCTION IN PONDS. *Bull. Brackishwater Aquacult. Dev. Cent. (Jepara)* 4(1-2):268-277. Jan.-July 1978. SFA 25(3)
[Brackishwater Aquacult. Dev. Cent., Jepara, Indonesia] The culture of milkfish (*Chanos chanos*) and giant tiger shrimp (*Penaeus monodon*) in the same pond compartment could increase production from 300 to 1800 kg/ha/yr. Implementation of the activities arranged in chronological order relative to the rearing of these cultivable and economic species is expected to produce 1200 kg of milkfish and 600 kg of shrimp, *P. monodon*.

80-001834 Nagy, A.; V. Csanyi; J. Bakos; and L. Horvath. DEVELOPMENT OF A SHORT-TERM LABORATORY SYSTEM FOR THE EVALUATION OF CARP GROWTH IN PONDS. *Bamidgeh* 32(1):6-15. Mar. 1980. SFA 25(3)
[Lab. Behav. Genet., L. Eötvos Univ., 2131 Göd, Hungary] The first step towards creating a laboratory test-system for the mass characterization of carp growth in ponds is reported. Growth values of experimental populations were established both in the laboratory and under field conditions. A method was developed for measurement of tolerance to hypoxia. Heritabilities of the characteristics examined have been determined. A high correlation was found between various growth parameters and the extent of hypoxia tolerance.

80-001835 Papoutsoglou, S. E.; E. G. Papaparaskeva-Papoutsoglou and P. K. Dendrinos. STUDIES ON THE EFFECT OF DENSITY ON BODY COMPOSITION, GROWTH RATE AND SURVIVAL OF RAINBOW TROUT FRY, REARED IN SEMICLOSED SYSTEM. *Thalassographica* 3(1):43-56. Nov. 1979. In English with Greek summ. SFA 25(3)
[Dep. Appl. Hydrobiol., Agric. Univ. Coll. Athens, Iera Odos 75, Votanicos, Athens, Greece]

80-001836 PROGRESS REPORT OF THE FRESHWATER AQUACULTURE CENTER. *Cent. Luzon State Univ. Freshwater Aquacult. Cent. Tech. Rep.* No. 15 iv + 121p. 1979. SFA 25(3)
[Freshwater Aquacult. Cent., Cent. Luzon State Univ., Muñoz, Nueva Ecija 2320, Philippines] A collection of papers.--RS

80-001837 Wohlfarth, G. W.; M. Lahman; G. Hulata and R. Moav. THE STORY OF "DOR-70," A SELECTED STRAIN OF THE ISRAELI COMMON CARP. *Bamidgeh* 32(1):3-5. Mar. 1980. SFA 25(3)
[Fish Aquacult. Stn., Dor, Israel]

WARMWATER CULTURE (CONTINUED)

80-001838 Zerunian, S. ACCRESCIMENTO IN CONDIZIONI NATURALI ED INTENSIVE DEL PERSICO TROTA (*MICROPTERUS SALMOIDES*) NEL BASSO LAZIO. [GROWTH OF LARGEMOUTH BASS (*MICROPTERUS SALMOIDES*) REARED IN POND AND IN CAGES IN SOUTHERN LATIUM (CENTRAL ITALY).] *Riv. It. Piscic. Ittiop.* 15(1):13-16. Jan.-Feb.-Mar. 1980. In Italian with English summ. SFA 25(3)

[Data concerning the growth of largemouth bass (*Micropterus salmoides*) in a natural pond located in southern Latium are reported. Good growth (mean weight at 2 years 600 g) as well as predation on the pumpkinseed sunfish (*Lepomis gibbosus*)--an undesirable species generally discarded by other carnivorous fish--are worth being stressed. An experiment of cultivation in submerged cages starting from a size of 4-5 cm was also carried out. Good acceptance of food, rapid growth (80 g attained on the average at 2 months), and lack of mortality were observed. These positive results are to be considered as a first step towards an intensive culture of the largemouth bass up to the market size.

MARICULTURE

80-001839 Hussain, N. A. and M. Higuchi. LARVAL REARING AND DEVELOPMENT OF THE BROWN SPOTTED GROUPER, *EPINEPHELUS TAUVINA* (FORSKÅL). *Aquaculture* 19(4):339-350. Apr. 1980. SFA 25(3)

[Maricult. Fish. Dep., Kuwait Inst. Sci. Res., P.O. Box 1638, Salmiya, Kuwait] *Epinephelus tauvina* (Forsål) has spawned naturally in captivity. The larvae were reared to metamorphosis using rotifers, *Artemia* nauplii, copepods and minced shrimp meat. The developmental stages from hatching through to metamorphosis are described. Larvae grew from 2.25 mm total length at hatching, to 31.40 mm by day 50. Two mortality peaks were observed: the first between days 4 and 5, and the second between days 24 and 35. The first peak corresponded to first feeding and the unsuitability of rotifiers, and the second to the change from feeding *Artemia* nauplii to copepods, which were not available in sufficient quantities.

FEEDS, FEEDING, AND NUTRITION

80-001840 Ablett, R. F. and R. H. Richards. SUITABILITY OF TWENTY-FOUR-HOUR AND FORTY-EIGHT-HOUR UNFED *ARTEMIA* AS AN EARLY FOODSTUFF FOR '0' GROUP DOVER SOLE (*SOLEA SOLEA* L.) PRODUCTION. *Aquaculture* 19(4):371-377. Apr. 1980. SFA 25(3)

[Dep. Food Sci. Technol., Oreg. State Univ., Corvallis 97331] A growth trial was conducted to assess the usefulness of two unfed *Artemia* nauplii regimes for '0' group Dover sole cultivation. San Francisco strain *Artemia salina*, harvested at either 24 h (30°C) and/or 48 hr (23°C), were investigated with sole between day 20 and day 85 post spawning. At day 60, a proportion of the fish from each trial was weaned onto *Lumbricillus* spp., an oligochaete used as a second stage foodstuff at Hunterston, Scotland. The results showed a pronounced growth increase in fish fed with 24-h *Artemia* compared to those reared on 48-h *Artemia*. *Lumbricillus* weaning produced a superior growth rate compared to both *Artemia* regimes, but had little effect on the growth differences established during *Artemia* feeding.

80-001841 Bromley, P. J. THE EFFECT OF DIETARY WATER CONTENT AND FEEDING RATE ON THE GROWTH AND FOOD CONVERSION EFFICIENCY OF TURBOT (*SCOPHTHALMUS MAXIMUS* L.). *Aquaculture* 20(2):91-99. June 1980. SFA 25(3)

[Minist. Agric. Fish. Food, Fish. Lab., Pakefield, Lowestoft, Suffolk, NR33 OHT, England]

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

80-001842 Bromley, P. J. EFFECT OF DIETARY PROTEIN, LIPID AND ENERGY CONTENT ON THE GROWTH OF TURBOT (*SCOPHTHALMUS MAXIMUS* L.). *Aquaculture* 19(4):359-369. Apr. 1980. SFA 25(3)
[Minist. Agric. Fish. Food, Fish. Lab., Pakefield, Lowestoft, Suffolk, England] Juvenile turbot were fed diets containing various proportions of protein and lipid. The fastest growth occurred on a diet rich in protein and low in lipd. The addition of extra lipid to the diet gave poorer growth but improved protein conversion efficiency. The protein sparing action of the lipid was most pronounced when the turbot were fed to about three-quarters of satiation on a diet supplemented with 6% lipid. Under these conditions 42% of the dietary protein was converted into fish protein, compared with 32% conversion on the basic diet which contained 0.5% lipid. There was a general decline in food conversion efficiency and protein sparing was marginal at the satiation feeding rate. Not all the dietary lipid was used in a protein sparing role, much of it was deposited as lipid reserves. In contrast, there was very little increase in the lipid content of fish fed on a high protein--low lipid diet.

80-001843 Fowler, L. G. SUBSTITUTION OF SOYBEAN AND COTTONSEED PRODUCTS FOR FISH MEAL IN DIETS FED TO CHINOOK AND COHO SALMON. *Prog. Fish-Cult.* 42(2):87-91. Apr. 1980. SFA 25(3)
[U.S. Fish Wildl. Serv., Abernathy Salmon Cult. Dev. Cent., Longview, WA 98632]

80-001844 Furuichi, M. and Y. Yone. EFFECT OF DIETARY DEXTRIN LEVELS ON THE GROWTH AND FEED EFFICIENCY, THE CHEMICAL COMPOSITION OF LIVER AND DORSAL MUSCLE, AND THE ABSORPTION OF DIETARY PROTEIN AND DEXTRIN IN FISHES. *Bull. Jpn. Soc. Sci. Fish.* 46(2):225-229. Feb. 1980. SFA 25(3)
[Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka 811-33, Japan] In order to investigate the utilization of carbohydrate by carp, (*Cyprinus carpio*, red sea bream, *Chrysophrys major*, and yellow tail, *Seriola quinqueradiata*, the fishes were reared on diets containing 0%, 10%, 20%, 30% and 40% dextrin for 30 days. Growth retardation and low feed efficiency were noticed in carp fed on a 40% dextrin diet, red sea bream on 30% dextrin and yellow tail on 20% dextrin. The rates of the increase in liver glycogen and the decrease in liver and muscle lipid were lowest in carp. On the other hand, comparably high percent absorption of protein and dextrin was determined in all species regardless of dietary dextrin levels. From these findings, it is presumed that the low growth and feed efficiency resulting from feeding high dextrin diets might be caused by the poor capability of utilizing the absorbed dextrin, and that the capacity of carp is highest among the fish tested.

80-001845 Johnson, E. A.; T. G. Villa; M. J. Lewis. *PHAFFIA RHODOZYMA* AS AN ASTAXANTHIN SOURCE IN SALMONID DIETS. *Aquaculture* 20(2):123-134. June 1980. SFA 25(3)
[Dep. Nutr. Food Sci., Mass. Inst. Technol., Cambridge 02139]

80-001846 Mahnken, C. V. W.; J. Spinelli and F. W. Waknitz. EVALUATION OF AN ALKANE YEAST (*CANDIDA* SP.) AS A SUBSTITUTE FOR FISH MEAL IN OREGON MOIST PELLET: FEEDING TRIALS WITH COHO SALMON (*ONCHORHYNCHUS KISUTCH*) AND RAINBOW TROUT (*SALMO GAIRDNERI*). *Aquaculture* 20(1):41-56. May 1980. SFA 25(3)
[Coastal Zone Estuarine Stud. Div., NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Up to 40% of the fish meal portion of the Oregon Moist Pellet (OMP) was replaced with up to 40% alkane yeast single cell protein (22% of dietary protein) in diets fed to rainbow trout in fresh water, and up to 100% of the fish meal portion was replaced with alkane yeast (54% of dietary protein) in OMP diets fed to coho salmon in salt water. Salmon diets were supplemented with DL-methionine to correct for a suspected

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

83-051948 CONTINUED deficiency in this essential amino acid. Alkaen yeast was an acceptable substitute for fish meal at all levels tested in trout. Only 25% yeast substitution was judged to be acceptable in the DMP diet for marine-cultured coho salmon, causing less than 4% reduction in growth. In marine-cultured coho salmon, growth was depressed further at fish meal substitution levels greater than 25%, while supplementation with DL-methionine enhanced growth and feed conversion only slightly.

83-051947 Ogino, C. [PROTEIN REQUIREMENTS OF CARP AND RAINBOW TROUT.] Bull. Jpn. Soc. Sci. Fish. 48(3):383-388. Feb. 1982. In Japanese with English summ. (FA 27(3))
(Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan)

83-051948 Ogino, C. [REQUIREMENTS OF CARP AND RAINBOW TROUT FOR ESSENTIAL AMINO ACID.] Bull. Jpn. Soc. Sci. Fish. 48(2):171-174. Feb. 1982. In Japanese with English summ. (FA 27(3))
(Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan)

83-051949 Fowler, L. G. and C. F. Cowey, Jr. NUTRITIONAL IMPLICATIONS OF THYROTROPHIN CATABOLISMS ENZYMES IN KIDNEYS OF TROUT AND SALMON. Proc. Soc. Exp. Biol. Med. 171(4):472-474. 1982. (FA 27(3))
(U.S. FWS, Tiburon Lab. Fish. Nutr., Portland, OR 13560)

83-051950 Akiyama, T. UPTAKE AND CONVERSION OF LAKE TROUT PED ESTROGENIC STARTER DIETS. Prog. Fish-Cult. 43(3):130-132. Apr. 1981. (FA 27(3))
(U.S. FWS, Bt. 1, Box 235, Spearfish, SD 57783)

83-051951 Akiyama, T. SOYBEAN MEAL AS A DIGESTIBLE FOR REDUCING MEAL IN PRACTICAL DIETS FOR RAINBOW TROUT. Prog. Fish-Cult. 43(2):109-114. Apr. 1981. (FA 27(3))
(U.S. FWS, Bt. 1, Box 235, Spearfish, SD 57783)

83-051952 Schroeder, G. L. THE RELATIONSHIP OF FEEDING RATES IN FISH POND CROPS (ABSTRACT OF LECTURE). Aquaculture 32(1-3):19-24. Mar. 1983. (FA 27(3))
(Fish. Aquacult. Res. Sta., Dor. Israel) The extreme competitive for natural feeds in densely stocked fish ponds drastically reduces standing crops as well as the production of organisms considered to occupy the various food niches. To satisfy their dietary needs, fish of different feeding characteristics are thought forced to be dependent upon food items ingested and selected under these conditions. The result is a shift to consumption of microorganisms of lower trophic level.

83-051953 Jarman, C. R., F. S. Gibson, T. Katayama and A. L. Figueroa. [Studies on effects of artificial diets on artificial diets and algae colony growth.] Bull. Jpn. Soc. Sci. Fish. 48(1):137-140. Feb. 1982. (FA 27(3))
(Dep. Food Sci. Technol. Univ. Calif., Davis, CA) Kingston (1981) in a joint study, live, wetfed, 1-day-old brine shrimp, artemia nauplii, and artificial, flaked diets were fed to atlantic silversides, Menidia menidia. Alone, separately or in various combination. The combination diets also varied in proportion of live to artificial components. After each experiment was terminated, growth and survival of the silversides were determined and analyses were made for amino acid and fatty acid compositions. Overall growth and survival data showed that cannibalized fish could be nurtured on a combination of artificial + brine shrimp diet to an extent as a 1-1 for artificial+ brine shrimp feeding ratio. Biochemical data were compared to reported requirements. Levels for essential amino acids and essential fatty acids in marine fish, and it was concluded that all diets

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

80-052871 (CONTINUED) seemed adequate in these two components. These data also indicated that fish accepted both artificial and live diets equally. Results further showed that dietary amino acids were generally not stored by silversides beyond levels required for tissue formation, whereas dietary fatty acids were accumulated to a much greater degree. Atlantic silversides cultured on an artificial diet alone, exhibited poorer growth and survival than fish cultured exclusively on a live brine shrimp diet. Although the reasons for the live diet's nutritive superiority remains a question, our results seem to eliminate an amino acid, fatty acid or digestive oxygen as the key to promotion good growth.

80-052874 Takeuchi, T.; S. Arai; T. Watanabe and T. Shiina. [REQUIREMENT OF EEL ANGUILLA JAPONICA FOR ESSENTIAL FATTY ACIDS.] Bull. Jpn. Soc. Sci. Fish. 46(3):343-352. Feb. 1980. In Japanese with English summ. 33k (fi;3)
(Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan)

80-052855 Watanabe, T.; A. Murakami; I. Takeuchi; T. Nose and T. Tajima. REQUIREMENT OF CHUM SALMON HELD IN FRESHWATER FOR LIPIDS AND PHOSPHORUS. Bull. Jpn. Soc. Sci. Fish. 46(2):241-247. Feb. 1980. 22k (fi;3)
(Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan)

THERMOPHILIC FISH

80-052854 Brigham, C. and T. Mulligan. THE EFFECT OF TEMPERATURE ON THE QUALITY OF EEL STOCKING MATERIAL. Aquaculture 20(3):229-240. June 1980. 46k (fi;3)
(Inland Fish. Inst., Helsinki, Finland)

80-052857 Shanks, S. E. and M. Mardjono. TEMPERATURE AND MILIEU SALINITIES FOR 50 DAYS BETTERA SPECIMEN BAITS. Bull. Brackishwater Aquacult. Dev. Cent. (Semarang) 4(1-2):104-107. Jan.-July 1979. 10k (fi;3)
(Brackishwater Aquacult. Dev. Cent., Jepara, Indonesia) Milkfish fry were transported to Singapore by using oxygenated plastic bags at the density of 1000 - 2000 fry per litre for 8-12 hours transportation time. More than 90 percent survival was obtained. Fry storage periods with floating water in the garden exclusively improved the quality of fry. Better survival rate was also noted when egg yolk was used as feed compared to the pelleted feed. Milk is longer period of storage is 2 x 24 h a problem but with the use of pelleted feed, the results was 70 percent survival rate of storage milkfish fry.

80-052856 Epifanio, J. L. and J. M. Srivastava. GROWTH RESPONSES OF TRANSPLANTED MILKFISH, Chanos Chanos FOR MARINE CULTURE, IN FISH PONDS (BROODSTOCK DEVELOPMENT AND CONDITIONING). Aquacult. Eng. 1(2):121-140. May 1982. In English with French summ. 48k (fi;3)
(Inland Fish. Res. Unit, Iloilo, Philippines)

MICROBIOLOGICAL CULTURE TECHNIQUES AND EQUIPMENT

80-052858 Chung, K. S. [The Examination of Bacterial Flora. Bull. Jpn. Soc. Sci. Fish. 46(2):141, Feb. 1980. 10k (fi;3)
(Dept. Oceanogr., Univ. Victoria, Victoria, Canada)

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT (CONTINUED)

80-001859 (CONTINUED)

80-001859 Holland, L. E. and G. S. Libey. [RECIRCULATING AQUACULTURE SYSTEMS] Int. Symp. Fish Cult. 6(2):112. Apr. 1980. 1979 25(1)
[Dep. For. Nat. Resour., Purdue Univ., West Lafayette, IN 47907]

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-001861 Jenkins, S. H., ed. [PROCEEDINGS OF SEEP LAKES]. Prog. Water Technol. 12(2):1-199. 1980. 1979 25(1)
A collection of papers.--ED

80-001862 Starrie, D. and J. D. Bennett. [RECENT TRANSITION FACIES IN LAKE ONTARIO]--A NUMERICAL STUDY OF THE CAUSES OF THE LARGE BIOLOGICAL AND CHEMICAL GRADIENTS. Can. J. Fish. Aquatic Sci. 37(5):823-833. May 1980. In English with French summ. 1979 25(1)
[ORST, Great Lakes Environ. Res. Lab., Ann Arbor, MI 48104]

PHYSICAL LIMNOLOGY AND OCEANOGRAPHY

80-001863 Hutchalter, D. E. [THERMAL AND HYDRAULIC CHARACTERISTICS OF A HORIZONTALLY DIFFUSERED THERM STREAM]. THE FISHERIA RIVER OF YELLOWSTONE NATIONAL PARK. Ph.D. dissertation, Mont. State Univ. Bldg. 1979. Diss Abstr. Int. B Sci. Eng. 40(11):5141. May 1980. 1979 25(1)

80-001864 Lawlor, J. E. and R. T. Lawlor. A MEMORIAL LOW-COST CURRENT METER FOR THE NEARSHORIZONT. Can. Dep. Fish. Oceans Tech. Rep. No. 926. v + 9p. May 1980. In English with French summ. 1979 25(1)
[Can. Dept. Inland Waters, 867 Lakeshore Rd., Burlington, ON L7R 4A6, Canada] A small but rugged, versatile current meter that was designed primarily as a peripheral tool in the small-craft sampling of plankton and larvae fish in Newfoundland. Only a single moving part, the rotor, is mechanically involved, and "on site" recovery and temperature information are obtained directly from the calibrated meter, or indirectly from chart and tape records. The current meter may be rigidly mounted to plankton samplers, moored for in situ data collection, or simply hand-held for subsite operation. The instrument may find wide application with hydrobiologists and hydrologists.

80-001865 Lutzenkirk, F. E. and R. R. Beck. [A] FREE-FLOW PROBE-TYPE MEASURING FOR CONFINED STREAM SAMPLES. Prog. Fish-Cult. 42(2):96-99. Apr. 1980. 1979 25(1)
[Connecticut Environ. Res. Lab., P.O. Box, 2333 Elm Hill Pk., Connecticut, CT 06115]

80-001866 Simons, T. J. [INVESTIGATION MODELS OF LAKES AND RELATED USES]. Can. Bull. Fish. Aquatic Sci. 203. viii + 146p. 1980. 1979 25(1)
[Dep. Environ., Natl. Waters Res. Inst., Burlington, ON L7R 4A6, Canada] The purpose of this monograph is to present a state-of-the-art report on models of temperature water circulation in lakes and seas. Specifically, this review is intended to provide the necessary background information for

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...Investigations of material transports and water quality problems in large natural basins. In view of the multidisciplinary nature of such studies, treatment of the present material starts from basic physical and mathematical principles. Following a review of the fundamental equations and approximations used in large-scale circulation models, vertical and horizontal variations of three-dimensional water motions are considered more or less separately. With regard to the vertical dependence, a series is presented of various layered model configurations as well as analytical solutions for vertical current variations. The latter discussion deals with frictional effects in homogeneous water and normal modes of stratified basins. Treatment of horizontal flow patterns begins with a review of numerical solution techniques applicable to high-speed computers. Model solutions are then presented for steady-state circulations in homogeneous basins, time-dependent homogeneous circulations, and stratified circulations. In each case the discussion proceeds from analytical solutions for idealized basin configurations to numerical results and model verifications for natural basins. It is concluded that presently available models render adequate simulations of the response of natural basins to wind forcing, but that results of long-term simulations appear less conclusive.

...SALICYLATE-HYPOCHLORITE ... IN SEAWATER. *Can. J. Fish. Aquatic Sci.* ... (May 1980). In English with French summ. SFA 25(3)
[... Fish., Inst. Aquarium Studs, P.O. Box 7-495, West Hartford, CT ...]

... FACTORS CONTROLLING OXYGEN ... *Can. J. Fish. Aquatic Sci.* 37(2):185-194. Feb. 1980. In English with French summ. SFA 25(3)
[... Winnipeg, MB R3T 2N6, Canada]

... B. E. Townsend; A. Swick and A. ... MERCURY-CONTAMINATED EXPERIMENTAL ... *Can. J. Fish. Aquatic Sci.* 37(5):848-857. May 1980. In English with French summ. SFA 25(3)
[... Winnipeg, MB R3T 2N6, Canada]

... DISTRIBUTION AND STATUS OF THE PLACID ... *Ann. Symp. Desert Fish. Counc.* ... (1980). Abstract only. SFA 43(3)
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[... Inst., Ithaca, N 14853]

BENTHOS (CONTINUED)

80-001872 Rosenberg, D. M.; A. P. Weins and B. Bilyj. SAMPLING EMERGING CHIRONOMIDAE (DIPTERA) WITH SUBMERGED FUNNEL TRAPS IN A NEW NORTHERN CANADIAN RESERVOIR, SOUTHERN INDIAN LAKE, MANITOBA. *Can. J. Fish. Aquatic Sci.* 37(6):927-936. June 1980. In English with French summ. SFA 25(3)
[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada]

80-001873 Särkkä, J. THE ZOOBENTHOS OF LAKE PÄIJÄNNE AND ITS RELATIONS TO SOME ENVIRONMENTAL FACTORS. *Acta Zool. Fenn.* No. 160. 46p. 1979. SFA 25(3)
[Dep. Biol., Univ. Jyväskylä, SF-40100 Jyväskylä 10, Finland]

PLANKTON

80-001874 Arai, M. N. and A. Brinckmann-Voss. HYDROMEDUSAE OF BRITISH COLUMBIA AND PUGET SOUND. *Can. Bull. Fish. Aquatic Sci.* 204. viii + 192p. 1980. SFA 25(3)
[Dep. Biol., Univ. Calgary, Calgary, AB T2N 1N4, Canada]

80-001875 Cooper, S. D. and C. R. Goldman. OPOSSUM SHRIMP (*MYSIS RELICTA*) PREDATION ON ZOOPLANKTON. *Can. J. Fish. Aquatic Sci.* 37(6):909-919. June 1980. In English with French summ. SFA 25(3)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106]

80-001876 Martinez, M. R. ALGAE IN FISHPONDS AND FISHPENS OF LAGUNA DE BAY, PHILIPPINES. I. EUGLENOPHYTA. *Kalikasan* 7(3):305-326. 1978. SFA 25(3)
[Dep. Bot., Coll. Arts Sci., Univ. Philippines at Los Baños, College, Laguna 3720, Philippines] Twenty-eight of the 194 species and varieties of algae identified in the fishponds and fishpens of Mayondon, Los Baños, Laguna, belong to Euglenophyta. These include 22 new records and 6 new varieties to make up a total of 49 species of euglenophytes known in the Philippines. Diagnostic descriptions, illustrations, and habitat records are given for each species or variety. A key is presented.

PRIMARY PRODUCTION

80-001877 Kaiman, S. J. and J. B. Dodell. RELATIONSHIPS BETWEEN METABOLIC PARAMETERS AND STREAM ORDER IN OREGON. *Can. J. Fish. Aquatic Sci.* 37(5):836-847. May 1980. In English with French summ. SFA 25(3)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

80-001878 Sullivan, S. A. and V. O. Shirhatti. EVALUATION OF THE ALGAL ASSAY BOTTLE TEST. *U.S. Dep. Interior Water Power Resour. Serv.* REC-ERC-80-1. 28p. Sept. 1979. SFA 25(3)
[Water Power Resour. Serv., Appl. Sci. Br., Chic. Spec., Eng. Spec. Cent., Denver, CO 80225]

MORPHOLOGY

60-001879 Castejón, O. J. and A. J. Caraballo. LIGHT AND SCANNING ELECTRON MICROSCOPIC STUDY OF CEREBELLAR CORTEX OF TELEOST FISHES. *Cell Tissue Res.* 207(2):211-226. 1980. SFA 25(3)
[Unidad Invest. Biol., Fac. Med., Univ. Zulia, Maracaibo, Venezuela]

60-001880 Agius, C. PHYLOGENETIC DEVELOPMENT OF MELANO-MACROPHAGE CENTRES IN FISH. *J. Zool. (Lond.)* 191(1):11-31. May 1980. SFA 25(3)
[Unit Aquatic Pathobiol., Univ. Stirling, Scotland]

60-001881 Altukhov, K. A. ON THE BIOLOGY OF THE EARLY STAGES OF DEVELOPMENT OF SOME WHITE SEA FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):104-113. 1979. SFA 25(3)
[White Sea Biol. Stn., Karelian Br., USSR Acad. Sci., USSR] Data are given on the larvae and fingerlings of some species of fish from the White Sea. The conditions of existence of the young are examined and features of the biology of the individual species are analyzed.

60-001882 Astakhov, D. A. DISCOVERY OF A PREMAXILLARY SEISMOSENSORY CANAL IN FISH OF THE BELONIFORMES ORDER BELONGING TO THE SCOMBERESOCIDAE AND BELONIDAE FAMILIES. *Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR Ser. Biol.)* 247(1-6):1067-1068. July-Aug. 1979. SFA 25(3)
[P. P. Shirsov Inst. Oceanol., Acad. Sci. USSR, Moscow, USSR]

60-001883 Best, A. C. G. and J. A. C. Nicol. EYESHINE IN FISHES. A REVIEW OF OCULAR REFLECTORS. *Can. J. Zool.* 58(6):965-956. June 1980. In English with French summ. SFA 25(3)
[Mar. Biol. Assoc. U.K., Citadel Hill, Plymouth, England]

60-001884 Duyvuk, C. L. and H. W. Muhr, Jr. LARAVAL DEVELOPMENT OF THE BLUNTNOSE MINNOW (*PIMEPHALES NOTATUS*) AND FATHEAD MINNOW (*PIMEPHALES PROMELAS*) FROM NORTHEAST PENNSYLVANIA. *Proc. Pa. Acad. Sci.* 53(2):172-176. 1979. SFA 25(3)
[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603]

60-001885 Cannon, M. S.; H. H. Hollenheuer; T. E. Burell; D. H. Lewis; A. M. Cannon and C. Tungaline. AN ULTRASTRUCTURAL STUDY OF THE LEUKOCYTES OF THE CHANNEL CATFISH, *ICTALURUS PUNCTATUS*. *J. Morphol.* 164(1):1-23. Apr. 1980. SFA 25(3)
[Dep. Anat., Tex. A&M Univ., College Station 77843]

60-001886 Dunelu, A.; A. Contini; S. Giannetto and A. Sardar. [illegible] IN UNA POPOLAZIONE DI *EPHEMERA AUCUTI* CODD & BITTNERMENTO DI ALCUNI ESEMPLARI DI *EPHEMERA GIGAS* LUTHER (PISCES: EPHEMERIDAE). [SYMMETRICAL ANALYSIS OF THE SPECIES *EPHEMERA AUCUTI* CODD AND NEW CAPTURE OF SOME SPECIMENS OF *EPHEMERA GIGAS* LUTHER (PISCES: EPHEMERIDAE)]. *Riv. Biol. Paras. Potol.* 3(3):139-146. 1977. In Italian with English summ. SFA 25(3)
[Ist. Zool. Anat. Comp., Univ. Messina, Italy]

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80-001887 Dunkelberger, D. G.; J. M. Dean and N. Watabe. THE ULTRASTRUCTURE OF THE OTOLITHIC MEMBRANE AND OTOLITH IN THE JUVENILE HUMMICHOG, *FUNDULUS HETEROCLITUS*. *J. Morphol.* 163(3):367-377. Mar., 1980. SFA 25(3)
[Dep. Biol., Univ. S.C., Columbia 29208]

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[Harbor Branch Found., Inc., RR 1, Box 196, Fort Pierce, FL 33450]

80-001889 Pisam, L. SCANNING AND TRANSMISSION ELECTRON MICROSCOPY OF THE SQUAMOUS GILL-FILAMENT EPITHELIUM FROM FRESH- AND SEAWATER ADAPTED *TILAPIA*. *Environ. Biol. Fishes* 5(2):161-165. 22 Apr. 1980. SFA 25(3)
[Dep. Zool., George S. Wise Fac. Life Sci., Tel Aviv Univ., Tel Aviv, Israel]

80-001890 Gauldie, R. W.; E. J. Grayworth and J. Illingworth. THE RELATIONSHIP OF THE IRON CONTENT OF SOME FISH OTOLITHS TO TEMPERATURE. *Comp. Biochem. Physiol. A Comp. Physiol.* 64(1):19-24. 1980. SFA 25(3)
[Fish. Res. Div., P.O. Box 19062, Wellington, New Zealand]

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[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL]

80-001892 Singhee, G. M. and A. K. Mittal. STRUCTURE OF THE GILLS OF *BARBUS SARANA* (HAM). A CYPRINID WITH TERTIARY LAMELLAE. *J. Fish Biol.* 16(4):461-467. Apr. 1980. SFA 25(3)
[Zool. Dep. Banaras Hindu Univ., Varanasi 221 005, India]

80-001893 Jørgensen, J. M. THE MORPHOLOGY OF THE LORENZINIAN AMPULLAE OF SOME OSTEICHIAN ACTINOPTERYGII (PISCES: CHONDROSTEI). *Acta Zool. (Stockh.)* 61(1):67-82. 1980. SFA 25(3)
[Zool. Lab., Univ. Aarhus, Denmark] The snout of a sturgeon, *Acipenser ruthenus* (Chondrostei, Acipenseriformes) is provided with sensory pores. Light and electron microscopical examination of these reveals that the ampullary organs have a sensory epithelium very similar to what has been found in the Lorenzinian ampullae, which are electroreceptive previously examined at a fine structural level in elasmobranchs and the paddlefish, *Polyodon spathula*. The sensory cells are pear-shaped with a very small apical part, in the centre of which there is a short cilium. Basally, the sensory cells make synaptic contacts with button-shaped nerve endings. The presumed synaptic area in the sensory cell is characterized by a presynaptic sheet surrounded by vesicles. Only one type of nerve ending, an afferent type, has been observed.

80-001894 Jollie, M. DEVELOPMENT OF HEAD AND POSTCRANIAL DERMAL SKELETON AND SCALES IN ACIPENSER. *Copeia* 1980(1):226-249. 1 May 1980. SFA 25(5)
[Dep. Biol. Sci., Fourth Fl. Univ., De Kalb 60115]

80-001895 Hiyahara, S.; S. Yamashita and J. Hirai. DISTRIBUTION OF TASTE BUDS ON THE LIPS AND INSIDE THE MOUTH IN THE SCIAENID, *PSEUDOSCIAENA PARVA*. *Physiol. Behav.* 24(6):1145-1147. June 1980. SFA 25(5)
[Biol. Inst., Fac. Liberal Arts, Nagasaki Univ., Nagasaki 90, Japan]

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80-001895 CONTINUED

80-001896 Kochkin, P. N. THE MORPHOLOGICAL CHARACTERISTICS OF THE "PIKE GLASSFISH", *CHANPSOCEPHALUS GUNNARI* (CHAENICHTHYIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):28-37. 1979. SFA 25(3)
[VNIRO, Moscow, USSR]

80-001897 Laale, H. W. THE PERIVITELLINE SPACE AND EGG ENVELOPES OF BONY FISHES: A REVIEW. *Copeia* 1980(2):210-226. 1 May 1980. SFA 25(3)
[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada] The perivitelline space enveloping the eggs of bony fishes prior to hatching is formed as a result of activation and fertilization and involves an egg shrinkage attributable to a fertilization induced cortical discharge of colloidal materal as well as an osmotic distension of the egg envelopes. The perivitelline fluid and its containing multilamellar envelopes with their varied specialized patterns and filamentous elaborations provide a number of protective, nutritive, flotative, polyspermy preventive and regulative functions. Fish eggs and embryos, by monitoring the immediate environment, possibly may modify the colloidal composition of the perivitelline fluid and the substructural organization of the egg envelopes in some instances, thus providing an adaptive mechanism for survival in a polluted environment. The review includes a discussion of the problematic issues surrounding membrane origin, structure and nomenclature, suggestions for further research and an extensive bibliography.

80-001898 Lauder, G. V., Jr. EVOLUTION OF THE FEEDING MECHANISM IN PRIMITIVE ACTINOPTERYGIAN FISHES: A FUNCTIONAL ANATOMICAL ANALYSIS OF *POLYPTERUS, LEPISOSTEUS,* and *AMIA*. *J. Morphol.* 163(3):283-317. Mar. 1980. SFA 25(3)
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[Sch. Environ. Sci., Plymouth. Polytech., Drake Circus, Plymouth, Devon, England] The pseudobranchs of bass, *Dicentrarchus labrax* L., and grey mullet, *Liza ramada* (Risso) (*Mugil capito*), were examined in the scanning electron microscope (S.E.M.). Both pseudobranchs appeared gill-like *in situ* but the S.E.M. revealed their gross morphology to be different. The bass pseudobranch was a 'free' pseudobranch, having separate lamellae along the filaments, with areas of fusion on the leading edges of some lamellae, whilst the mullet pseudobranch was 'semi-free' since the secondary lamellae were fused over a large area and only free along their trailing (opercular) edge where the chloride cells were situated. The surface of the epithelial cells presented different patterns of microridges and microvilli depending on the position in the pseudobranch. Three types of cell opening were found at the cell surface, belonging to chloride cells, mucous cells, and possibly rodlet cells. The S.E.M. observations were correlated with those of transmission electron microscope (T.E.M.) studies.

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[Univ. Tex., Mar. Sci. Inst., Port Aransas Mar. Lab., Port Aransas 78373]

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[Norwegian Food Res. Inst., P.O. Box 50, N-1432 Ås-NLH, Norway] The ultrastructural details of Z-discs from red, intermediate, and white axial muscle fibres from the sharks *Etmopterus spinax* and *Galeus melastomus* are described. Red fibre Z-discs contain the most amorphous matrix material, and are thicker (100-115 nm) than intermediate (85-88 nm) and white Z-disks (75-80 nm). Four sets of oblique bars extend tangentially from each thin filament. In each set two bars are present, those of white fibres are close together (approximately 5 nm), while those of red fibres are separated by a distance of 15 nm. A model of shark Z-disc structure is proposed. The denaturation (heat transaction) temperature of the muscle proteins were studied by differential scanning calorimetry (DSC). The heat transitions of collagen, actin, and myosin were identified; the actin heat transition temperature increased in the sequence red, intermediate, and white. The total protein pattern of red and white muscle were studied by SDS electrophoresis. A protein with a molecular weight of about 55,000 may represent a Z-disc protein.

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[Ill. State Nat. Hist. Surv., Aquatic Biol. Sect., Nat. Resour. Bldg., Urbana 61801] Shortnose sturgeon (*Acipenser brevirostrum*) protolarvae, ranging from 8.0 to 12.5 mm TL, had 20-23 postanal and 33-36 preanal myomeres and the preanal length was 66-70% of TL. The yolk sac was large, the pectoral fin buds were barely visible, and the entire body was covered with expanded melanophores. Mesolvarvae of 13.0-14.7 mm TL had 22 postanal and 34 preanal myomeres, and preanal length was 61% of TL. The yoke sac was nearly gone, barbels, mouth, and pectoral fins were well developed and the anlage of the dorsal fin was visible. Mouth width of the 14.7 mm TL mesolarva was 71% of the head width and teeth were present.

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[Dep. Med., Peter Bent Brigham Hosp., 721 Huntington Ave., Boston, MA 02115]

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[R. M. Laurs: NMFS, La Jolla, CA 92038]

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[Fish Wildl. Div., Alberta Energy Nat. Resour., Sam Livingston Fish Hatchery, Calgary, AB T2G 4T9, Canada]

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[J.-L. Gallis: Inst. Univ. Biol. Mar., 2 rue du Pr. Jolyet, 33120 Arcachon, France]

80-001936 Benjamin, M. A CORRELATION BETWEEN PITUITARY AND INTEGUMENTARY STRUCTURE IN THE NINE-SPINED STICKLEBACK, *PUNGITIUS PUNGITIUS* L. *Acta Zool. (Stockh.)* 61(2):105-109. 1980. SFA 25(3)
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[Arthur Rylah Inst. Environ. Res., Brown St., Heidelberg, Victoria, Australia] Adult and juvenile *Therapon unicolor* and adult and juvenile *Nematocentris splendida* have been found to tolerate temperatures of 41.8°C, 35.5°C, 34.4°C and 31.4°C respectively. These upper temperature tolerance limits were calculated as LD_{50} values from percentage survival curves. Salinity tolerances determined by direct transfer, gradual acclimation and long-term tolerance, show that *T. unicolor* tolerates salinities as high as 35.5°/oo while *N. splendida* could not tolerate salinities higher than 17.8°/oo. Attempts to induce aestivation in *T. unicolor* were unsuccessful.

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[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, England]

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[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

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[U.S. EPA, 6201 Congdon Blvd., Duluth, MN 55804]

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[Mar. Biol. Prog., Univ. New England, Biddeford, ME 04005] Ten *Canthigaster jactator*, tropical marine puffers from Hawaii, were tested individually for 3-day periods in electronic shuttleboxes (ichthyotrons) to determine their ability to thermoregulate behaviorally. These fish thermoregulated with a degree of precision comparable to that of temperate freshwater fishes: range 23-31°C, S.D. 1.8-2.6°C, S.E. 0.3-0.5°C. The modal final thermal preferendum was 27°C, comparable to temperate warmwater fishes. The mean preferred temperature did not differ significantly between night (26.5°C) and day (26.9°C); the 24-hr mean was 26.7°C. Apparently at least some tropical marine fishes are capable of thermoregulatory behavior similar to that of temperate freshwater fishes.

80-001948 Chervinski, J. NOTE ON THE ADAPTABILITY OF BIG-HEAD (*ARISTICHTHYS NOBILIS*) TO VARIOUS SALINE CONCENTRATIONS. *Bamidgeh* 32(1):27-29. Mar. 1980. SFA 25(3)
[Fish Aquacult. Res. Stn., Dor, Israel] A preliminary investigation was carried out under laboratory conditions in order to determine the feasibility of raising Big-Head (Chinese carp) in brackish water. Big-head (*Aristichthys nobilis*) juveniles of 35-40mm total length were transferred from fresh water to mixed salt and tap water of the following proportions: 15‰ (8+4‰), 20‰ (8+8‰), and 25‰ (8+12‰). All the fish survived a 48 hour stay in 15‰ and 20‰ salt water; there was 70‰ mortality in 25‰ salt water.

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[Dep. Zool., Biol. Sci. Bldg., Univ. Alberta, Edmonton, AB T6G 2E9, Canada] Sexually mature goldfish maintained under a 16L:8D photoperiod were induced to ovulate by warming from 12 to 21° in the presence of aquatic vegetation. A surge in serum cortisol, measured by radioimmunoassay, occurs at the onset of the dark phase, 4 to 8 hr prior to ovulation. Cortisol may play a physiological role in ovulation in the goldfish.

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[Dep. Gen. Biol., Med. Acad., 15-230 Bialystok, Poland]

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[Dep. Biol., Sci. Educ. Inst. Osaka Pref., Osaka 558, Japan]

80-001953 Daikoku, T. EFFECTS OF DIETARY TRIMETHYLAMINE ON THE ALKALINE PHOSPHATASE AND REDUCTASE ACTIVITIES IN THE GUPPY, *POECILIA RETICULATA*, IN RELATION TO SEAWATER ADAPTATION. *Comp. Biochem. Physiol. B Comp. Biochem.* 66(1):99-103. 1980. SFA 25(3)
[Dep. Biol., Sci. Educ. Inst. Osaka Pref., Osaka 558, Japan]

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[N.E.R.C. Unit Mar. Invert. Biol., Mar. Sci. Lab., Menai Bridge, Gwynedd, Wales] Unfertilised cod eggs showed a mean oxygen uptake rate at 5°C of 0.089 µl O_2/mg dry wt/h; this gradually rose to 0.768 µl O_2/mg dry wt/h in eggs about to hatch. From hatching to complete yolk absorption larvae respired at 1.6µl O_2/mg dry wt/h. During starvation following yolk absorption, uptake fell significantly to 1.1 µl O_2/mg dry wt./h. Much of this decrease in oxygen consumption was shown to be caused by reduction in activity. Loss of weight during the embryo and larval phases could not easily be reconciled with total oxygen consumption; it is suggested that cod embryos and larvae may not rely solely upon endogenous energy reserves during development.

80-001955 Daxboeck, C. and G. F. Holeton. THE EFFECT OF MS-222 ON THE HYPOXIC RESPONSE OF RAINBOW TROUT (*SALMO GAIRDNERI*). *Comp. Biochem. Physiol. C Comp. Pharmacol.* 65(2):117-121. 1980. SFA 25(3)
[Dep. Zool., Univ. British Columbia, 2075 Wesbrook Mall, Vancouver, BC V6T 1W5, Canada] The response of *S. gairdneri* to environmental hypoxia is biphasic: heart rate and ventilatory rate. Several loci of control for the hypoxic response exist, both centrally and peripherally. MS-222 decreases receptor sensitivity and increases time of response expression in a dose-dependent fashion. Peripheral oxygen receptors are affected most

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PHYSIOLOGY (CONTINUED)

80-001955 CONTINUED rapidly and reversibly by MS-222, while other effects are more slowly expressed but less rapidly reversed.

80-001956 Delahunty, G. and V. L. de Vlaming. PHOTOPERIOD-TEMPERATURE INTERACTIONS ON LIVER AND PLASMA METABOLITES IN THE GOLDFISH, *CARASSIUS AURATUS*. *Comp. Biochem. Physiol. A Comp. Physiol.* 66(3):507-512. 1980. SFA 25(3)
[V. L. de Vlaming: Dep. Biol., Marquette Univ., Milwaukee, WI 53233] Plasma and liver metabolites were measured in goldfish after 3 weeks acclimation to one of four different photoperiod-temperature regimes (16L/8D-22°C; 16L/8D-13°C; 8L/16D-22°C; 8L/16D-13°C) during September and April. Samples were taken at the mid-light and mid-dark point of each photoregime. Photoperiod altered levels of plasma protein and plasma cholesterol. Temperature affected the levels of liver glycogen, plasma glucose, organic bound phosphorus and protein. Time of sampling was important in assessing both photoperiod and temperature effects on metabolites. Interaction between photoperiod and temperature was observed in the levels of liver glycogen and plasma glucose. The interaction was dependent on sampling time. Seasonal differences were noted in the day-night variation of specific metabolites and of the photoperiod effects on plasma cholesterol levels.

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[Cent. Genet. Molec. CNRS, F-91190 Gif-sur-Yvette, France]

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[Dep. Ichthyol., Univ. Teheran, B.P. 3262, Teheran, Iran]

80-001959 Farkas, T.; I. Csengeri; F. Majoros and J. Oláh. METABOLISM OF FATTY ACIDS IN FISH. III. COMBINED EFFECT OF ENVIRONMENTAL TEMPERATURE AND DIET ON FORMATION AND DEPOSITION OF FATTY ACIDS IN THE CARP, *CYPRINUS CARPIO* LINNAEUS 1758. *Aquaculture* 20(1):29-40. May 1980. SFA 25(3)
[Inst. Biochem., Biol. Res. Cent. Hungarian Acad. Sci., H-6701 Szeged, Hungary]

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80-001961 Fletcher, G. L. and J. C. Smith. EVIDENCE FOR PERMANENT POPULATION DIFFERENCES IN THE ANNUAL CYCLE OF PASMA "ANTIFREEZE" LEVELS OF WINTER FLOUNDER. *Can. J. Zool.* 58(4):507-512. Apr. 1980. In English with French summ. SFA 25(3)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada] Seasonal changes in plasma freezing point depression and Cl^- concentration in a population of Nova Scotian winter flounder were compared with the seasonal changes which occurred in a population of Newfoundland flounder. The plasma protein "antifreeze" component of the freezing point depression was computed by subtracting the freezing point depression due to the concentration of plasma electrolytes from the total plasma freezing point depression. In Nova Scotian flounder the plasma "antifreeze" level increased

PHYSIOLOGY (CONTINUED)

80-001961 CONTINUED approximately 1 month later and declined 2 months earlier than it did in Newfoundland flounder. These differences between the two populations of fish correlated with the regional differences in seawater temperature. When Nova Scotian flounder were transferred to Newfoundland and maintained under Newfoundland conditions of water temperature and photoperiod they retained their plasma "antifreeze" cycle for the duration of the study (approximately 1 year). These results suggest that the timing of the annual plasma "antifreeze" cycle may be a permanent feature of the flounder's physiology and that water temperature does not directly control it. It is hypothesized that some aspects of the annual antifreeze cycle may be endogenous and that if photoperiod plays a role in its regulation the differences between Newfoundland and Nova Scotia are too slight for the cycle to be adjusted in 1 year.

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[Lab. Biol. Mar., Coll. France, F-29110 Concarneau, France]

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[Spez. Zool., Ruhr-Univ. Bochum, D 4630 Bochum, West Germany]

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[Arizona State Univ., Tempe] The reproductive performance of the desert pupfish, *Cyprinodon n. nevadensis*, was tested for relationship with salinity. Breeding pairs were exposed to a range from nearly 0°/oo to over 40°/oo salinity. In the reproductive parameters utilized; eggs per gram body weight per day, eggs per spawning and the % hatch, the pupfish reproduced best at 10°/oo and gradually below 10°/oo, producing a plateau of statistically equivalent reproduction from .3 to 20°/oo. This species of pupfish exhibited an upper salinity tolerance of 53°/oo and a lower limit of less than 0.1°/oo, in a 96 hour LD-50 test.

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[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093]

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[U.C.N.W. Mar. Sci. Lab., Menai Bridge, Gwynedd, North Wales] Foregut emptying in*Blennius pholis* at 16-18°C is exponential ($S_t=S_0e^{-Rt}$; R=0.006 when t is in min and s in mg dry weight). In consequence, the time for the foregut to empty completely varies in proportion to ln (meal size) in a chosen size of fish or to ln (body weight) in different sized fish fed to the same relative amount (% body weight). Appetite returns rapidly in comparison with other species (4-15 h for fish of 0.5-30 g) and, because of the tidal constraints imposed on this littoral fish, voluntarily ingested meals are large (14-9% body weight depending on fish size). Studies on digestion in small, stomachless fish are not adequately made using X-radiography and must be supported by sequential gut samples after a meal.

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[Tokai Reg. Fish. Res. Lab., Arasaki, Nagai, Yokosuka 238-03, Japan]

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[Biol. Dep., Boston Univ., Boston, MA 02215]

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[Lab. Biol. Mar., Fac. Cathol. de Lille, 62164 Ambleteuse, France] In the Perch, the relation between the two variables that are the incubation time (Y) and the temperature (X) cannot be expressed in "degree-days". A regression line is constructed from the logarithmic coordinates and we obtain the relation: $\log Y = -1.72 \log X + \log 1039$ or $YX^{1.72} = 1039$.

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[Dep. Biol., Subdep. Anim. Physiol., Wilhelm-Pieck-Univ. Rostock, 25 Rostock, West Germany]

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[I.N.R.A., Lab. Physiol. Poissons, Campus Beaulieu, 35042 Rennes Cedex, France]

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[Surgical Res. Lab., Inst. Med. Sci., Banaras Hindu Univ., Varanasi-221005, India]

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[Ecol. Curric., Univ. N.C., Chapel Hill 27514] Recent food habit and productivity research on the killifish, *Fundulus heteroclitus* (L.), suggests that this species is important in the movement of organic material within and out of the salt marsh ecosystem. The stable carbon isotope ratios of *Fundulus* muscle tissue and gut contents were measured seasonally to determine the carbon sources of the killifish. For muscle $\delta^{13}C$ values ranged from -13.9°/oo to -15.8°/oo and -15.8°/oo to -18.4°/oo for gut contents, suggesting differential assimilation of ingested material. Muscle tissue values indicate that assimilated carbon probably originated from a mixture of benthic algae and *Spartina* ingested by major prey species: the fiddler crab, *Uca pugnax* (Smith); the polychaete, *Nereis (Neanthes) succinea* Frey and Leuckart; the tanaid, *Leptochelia rapax* Harger; and other small crustaceans. Small fish (age 0-1 yr) showed slightly lower $\delta^{13}C$ values than larger fish (age 1-3 yr), consistent with differences in their feeding habits. The only seasonal pattern was an enrichment in tissue ^{13}C that occurred for both small and large fish in the spring, corresponding to the peak spawning period. The $\delta^{13}C$ determination is a useful tool in identifying and tracing carbon sources through the salt marsh food web, detecting differences in feeding habits between age classes of organisms, and assessing the relative nutritive value of ingested dietary items if differential assimilation is suspected.

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[I. M. Sechenov Inst. Evol. Physiol. Biochem., USSR Acad. Sci., Leningrad, USSR] Rainbow trout, *Salmo gairdneri*, were kept for 8 hours at a temperature of 10° in fresh water, taken from the Ropsha Ponds, and in distilled water with saline solutions containing the chloride salts of sodium, potassium, calcium and magnesium sulphate in concentrations equal to the amount contained in the water of the Ropsha Ponds. Sodium in particular is taken up from the water, the remaining cations do not influence the sorption of sodium and the zero balance of calcium and sorption of magnesium are noted only when their content in the water is relatively high. The rate at which ions are lost to the water is low in relation to their total content in the trout.

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[Dep. Microbiol., Univ. Aberdeen, Aberdeen, Scotland] The digestive tracts of 138 marine, freshwater and farmed fish representing 42 species were assayed for cellulase activity using viscometry. Activity was exhibited by the majority of fish but the level of activity was variable within and between species and was not located in any particular region of the gut. The majority of omnivorous and piscivorous fish demonstrated nil or slight activity, wheras most 'invertivores' exhibited moderate and high activity levels. This suggests that cellulase activity in fish is the direct result of the ingestion of invertebrates containing cellulase and/or a cellulolytic microflora.

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[Dep. Primary Ind., Fish. Div., Papua, New Guina] A detailed examination of the sexuality of *L. calcarifer* led to the conclusion that it was a protandrous hermaphrodite. The smaller length classes are almost exclusively male, the percentage of females increasing with increased total length. Length frequencies, calculated from the dissection of 5202 mature specimens, give a male mode at 89.5 cm and a much smaller female one at 101.5 cm. The overall sex ratio is 3.8:1 in favour of males. There is a small proportion of primary females and also the possiblity that some males do not undergo the change to female. Biopsy experiments were used to confirm protandric sex inversion. As the gonads of *L. calcarifer* are strongly dimorphic, inversion of sex requires a complete reorganization of gonad structure as well as function. Few hermaphrodite gonads were detected, this being attributed to a rapid transition phase from male to female and the lack of sampling during the period when transitions are most likely to occur.

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[Fac. Fish., Hokkaido Univ., Hakodate, Hokkaido, 041, Japan] The source of calcium for scale regeneration was studied in the descaled goldfish, *Carassius auratus*. ^{45}Ca-prelabeled fish showed no stimulated rate of calcium resorption from the remaining scales, vertebrae and ribs during scale regeneration. The calcium content of the tissues also remained unchanged. Environmental ^{45}Ca was heavily incorporated into regenerating scales and the rate of incorporation was highest in the second week following scale removal. The results indicate that exogenous calcium, rather than endogenous, is primarily utilized for scale regeneration of goldfish.

PHYSIOLOGY (CONTINUED)

80-002002 Neshumova, T. V. THE DYNAMICS OF CHANGES IN THE ELECTRICAL ACTIVITY AND TEMPERATURE OF DIFFERENT TYPES OF MUSCLES IN THE LAKE BAIKAL GRAYLING, *THYMALLUS ARCTICUS BAICALENSIS*, DURING PROLONGED SWIMMING. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):139-143. 1979. SFA 25(3)
[Inst. Physiol., Siberian Dep., Acad. Med. Sci., Novosibirsk, USSR] The dynamics of the electromyographic activity (EA) of motor (red, white) and respiratory muscles was studied, along with changes in the temperature of the red muscles of the Baikal grayling, *Thymallus arcticus baicalensis*, during swimming at a speed of 2.5 L/sec. Electrical activity and changes in the temperature of the muscles studied are higher by 30-120% in the first minutes of swimming relative to the stable values of these indicators characteristic of further swimming at this speed. This nature of the changes of the indicators is a reflection of the heightened functional activity of the motor and respiratory muscles in the first minutes of swimming of the Baikal grayling.

80-002003 Oguri, M. PRESENCE OF JUXTAGLOMERULAR CELLS IN TROUT KIDNEYS. *Bull. Jpn. Soc. Sci. Fish.* 46(3):295-297. Feb. 1980. SFA 25(3)
[Fish. Lab., Fac. Agric, Nagoya Univ., Nagoya 464, Japan]

80-002004 Olcese, J. M. and V. L. De Vlaming. INTERACTION OF ENVIRONMENTAL PHOTOPERIOD AND TEMPERATURE ON HYPOTHALAMIC MONOAMINE OXIDASE ACTIVITY IN *CARASSIUS AURATUS* L. *Comp. Biochem. Physiol. A Comp. Physiol.* 66(1):153-155. 1980. SFA 25(3)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-002005 Olcese, J.; C. Darr; B. DeMuri; T. R. Hall and V. de Vlaming. PHOTOPERIOD EFFECTS ON HYPOTHALAMIC SEROTONERGIC ACITIVITY IN THE GOLDFISH, *CARASSIUS AURATUS*. *Comp. Biochem. Physiol. A Comp. Physiol.* 66(2):363-365. 1980. SFA 25(3)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-002006 Olivereau, M.; J.-M. Olivereau and C. Aimar. RESPONSES OF MSH AND PROLACTIN CELLS TO 5-HYDROXYTRYPTOPHAN (5-HTP) IN AMPHIBIANS AND TELEOSTS. *Cell Tissue Res.* 207(3):377-385. Apr. 1980. SFA 25(3)
[Lab. Physiol., Inst. Oceanogr., Paris, France]

80-002007 Olson, D. L. and G. M. Christensen. EFFECTS OF WATER POLLUTANTS AND OTHER CHEMICALS ON FISH ACETYLCHOLINESTERASE (*IN VITRO*). *Environ. Res.* 21(2):327-335. Apr. 1980. SFA 25(3)
[U.S. EPA, 6201 Congdon Blvd., Duluth, MN 55804] Acetylcholinesterase (AChE) preparations from the muscle of the fathead minnow (*Pimephales promelas* Rafinesque) were treated (*in vitro*) with 74 chemicals of various classes, many of which are environmental contaminants, to determine their effect upon enzyme activity. A highly inhibitory effect was found with several carbamates, one organo-oxy-phosphate, the arsenite ion, and certain heavy metal cations. Intermediate inhibition was found with the arsenate ion, other metal cations, organometals, certain neuroactive agents, organophosphates, and one organochloride pesticide. Several organochloride pesticides, alkaline and alkaline-earth cations, a variety of anions, several drugs, and other chemicals had little inhibitory effect at the highest concentration used (0.01 M). The effect of chemicals in mixtures of known composition was approximately additive. None of the chemicals tested caused detectable enzyme activation.

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80-002008 Papoutsoglou, S. E. and E. G. Papaparaskeva-Papoutsoglou. OBSERVATIONS ON HAEMATOLOGICAL AND LIVER CHARACTERISTICS OF FARMED RAINBOW TROUT (*SALMO GAIRDNERI*, R.). *Thallassographica* 3(1):21-34. Nov. 1979. In English with Greek summ. SFA 25(3)
[Dep. Appl. Hydrobiol., Agric. Univ. Coll. Athens, Iera Odos 75, Votanikos, Athens, Greece]

80-002009 Penney, R. K. and G. Goldspink. TEMPERATURE ADAPTATION OF SARCOPLASMIC RETICULUM OF FISH MUSCLE. *J. Therm. Biol.* 5(2):63-68. Apr. 1980. SFA 25(3)
[Muscle Res. Lab., Dep. Zool., Univ. Hull, Hull HU6 7RX, England]

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[Inst. Hydrobiol. Fischereiwiss., Univ. Hamburg, West Germany]

80-002011 Pettersson, K. and S. Nilsson. DRUG INDUCED CHANGES IN CARDIO-VASCULAR PARAMETERS IN THE ATLANTIC COD, *GADUS MORHUA*. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 137(2):131-138. May 1980. SFA 25(3)
[Dep. Zoophysiol., Univ. Göteborg, Fack, S-400 33 Göteborg, Sweden]

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[Dep. Physiol. Biophys., Univ. Ill., Urbana 61801]

80-002013 Porter, D. A. and A. J. Fivizzani. THE INFLUENCE OF TEMPERATURE, DAYLENGTH AND SALINITY IN GONADAL DEVELOPMENT OF THE BANDED KILLIFISH, *FUNDULUS DIAPHANUS*. *Proc. N. D. Acad. Sci.* 34:50. Apr. 1980. SFA 25(3)
[Biol. Dep., Univ. N. Dak., Grand Forks 58202]

80-002014 Potter, I. C.; R. W. Hilliard and D. J. Bird. METAMORPHOSIS IN THE SOUTHERN HEMISPHERE LAMPREY, *GEOTRIA AUSTRALIS*. *J. Zool. (Lond.)* 190(3): 405-430. Mar. 1980. SFA 25(3)
[Sch. Environ. Life Sci., Murdock Univ., Murdoch, West. Australia 6153, Australia]

80-002015 Priede, I. G. and F. G. T. Holliday. THE USE OF A NEW TILTING TUNNEL RESPIROMETER TO INVESTIGATE SOME ASPECTS OF METABOLISM AND SWIMMING ACTIVITY OF THE PLAICE (*PLEURONECTES PLATESSA* L.). *J. Exp. Biol.* 85:295-309. Apr. 1980. SFA 25(3)
[Dep. Zool., Univ. Aberdeen, Scotland] Plaice and other flatfish can be induced to swim down a slope of about 60°C against an upwelling water flow in a water tunnel. A tilting Brett-type tunnel respirometer based on the above principle enabled laboratory experiments on swimming plaice to be carried out. From trials at 5°, 10°C, 15°C, the relationship between specific swimming speed, V (body lengths/s), oxygen consumption, R (l/mg·l/kg/h) and temperature, T is: $\log_{10}$ = 0.3318V + + $\log_{10}$(2.45T + 26.52). If the fish is resting (i.e. V = o), the oxygen consumption is lower than predicted by the above equation. At rest: R = 2.14T + 2.66. The cost of swimming in plaice is very similar to that of typical round fish such as haddock but the resting metabolic

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80-002015 CONTINUED rate is lower than for haddock. Before swimming, a negatively buoyant fish such as plaice must lift off the bottom. This cost of lift-off or posture effect makes it uneconomical for plaice to swim at speeds below 0.6V.

80-002016 Primor, N.; I. Sabnay; V. Lavie and E. Zlotkin. TOXICITY TO FISH, EFFECT ON GILL ATPase AND GILL ULTRASTRUCTURAL CHANGES INDUCED BY *PARDACHIRUS* SECRETION AND ITS DERIVED TOXIN PARDAXIN. *J. Exp. Zool.* 211(1):33-43. Jan. 1980. SFA 25(3)

[Dep. Zool., Hebrew Univ. Jerusalem, Jerusalem, Israel] The ichthyotoxic mechanism of the Red Sea flatfish *Pardachirus marmoratus* crude secretion (PMC) and its derived toxin pardaxin was investigated using in vivo lethality tests and in vitro gill preparations of fish preadapted to different salinities. Comparative studies with ouabain and cytotoxin (a factor derived from cobra snake venom) were performed and it has been found that: 1) The lethal potencies of PMC increased in fish adapted to salinities above and below the isotonic level. 2) In contrast to PMC and pardaxin the lethal effects of ouabain and cytotoxin were weak upon external application and potent by injection. 3) When compared to ouabain, pardaxin was found to be about three and five orders of magnitude more potent gill ATPase inhibitor in fish and crustacean preparations, respectively. 4) EM studies of gills obtained from fish treated by sublethal doses of PMC revealed the appearance of apical crypts in gill chloride cells.

80-002017 Pritchard, J. B.; J. B. Anderson; D. P. Rall and A. M. Guarino. COMPARATIVE HEPATIC AND RENAL HANDLING OF PHENOL RED AND INDOCYANINE GREEN BY CYCLOSTOME, ELASMOBRANCH AND TELEOST FISH. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 65(2):99-104. 1980. SFA 25(3)

[Lab. Pharmacol., Natl. Inst. Environ. Health Sci., P.O. Box 12233, Research Triangle Park, NC 27709]

80-002018 Pullin, R. S. V.; D. J. Morris; C. R. Bridges and R. J. A. Atkinson. ASPECTS OF THE RESPIRATORY PHYSIOLOGY OF THE BURROWING FISH *CEPOLA RUBESCENS* L. *Comp. Biochem. Physiol. A Comp. Physiol.* 66(1):35-42. 1980. SFA 25(3)

[Int. Cent. Living Aquatic Resour. Manage., MCC P.O. Box 1501, Makati, Metro Manila, Philippines]

80-002019 Rahmann, H. and R. Hilbig. BRAIN GANGLIOSIDES ARE INVOLVED IN THE ADAPTATION OF ANTARCTIC FISH TO EXTREME LOW TEMPERATURES. *Naturwissenschaften* 67(5):259-260. May 1980. SFA 25(3)

[Inst. Zool. Univ., D-7000, Stuttgart, West Germany]

80-002020 Rubec, P. J. EFFECT OF PHEROMONES ON BEHAVIOR OF ICTALURID CATFISH. *Ph.D. dissertation, Tex. A&M Univ.* 178p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5575. June 1980. SFA 25(3)

The behavioral responses of channel catfish (*Ictalurus punctatus*) and black (*I. melas*), brown (*I. nebulosus*) and yellow bullhead (*I. natalis*) to pheromones were monitored. Channel catfish were significantly attracted to the water-borne odor of an immature female conspecific and exhibited a significant interaction between the donor's odor, sex of test fish and water flow. The odor was also efficiently localized without a differential in water flow by both channel catfish and brown bullhead. The above species were significantly attracted to their own substrate marks. The attraction of channel catfish to PVC tubes within species indicated preferences for their own residence tubes, plus attraction to the tube of a conspecific. Male channel catfish, following exposure to conspecifics, recognized and avoided their substrate marks on tubes. Channel catfish

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80-002020 CONTINUED exhibited a greater attraction to tubes of black bullheads than to the respective tubes of yellow and brown bullheads. Sexually mature black bullheads showed a strong attraction to the tubes of sexually mature conspecifics over those of immature fish of either sex. These data indicate recognition of different substrate marks according to sex, species and state of sexual maturity of the donors. The chemical cues may allow home site recognition and territorial marking. Mature female black and brown bullheads distinguished and were attracted to urine from conspecifics of the opposite sex. They also preferred the urine of their own species. Urine responses varied from strong attraction to avoidance depending on the physiological state of the donors. Skin, axillary gland and seminal vesicles were found to be anatomical sources of pheromones. The responses of individual test fish to extracts of these tissues varied. Extracts of skin and axillary glands caused avoidance and attraction-avoidance responses at high and low concentration. Dilution of samples indicated the behavior of test fish shifted from avoidance to attraction at an optimal concentration. There was also evidence of a concentration dependence with urine samples. Seminal vesicle solutions were highly attractive. The consecutive testing of different tissue extracts, or dilutions of the same solution, allowed the assessment of behavioral changes with the same test fish. The bioassay of urine extracts indicated the presence of both lipoidal and non-lipoidal pheromones in urine. The latter appeared to be proteinaceous. Male donors, while being injected with human chorionic gonadotropin, appeared to produce one or the other of these pheromones. This indicates the influence of hormones on pheromone production.

80-002021 Sakata, T.; J. Okabayashi and D. Kakimoto. VARIATIONS IN THE INTESTINAL MICROFLORA OF *TILAPIA* REARED IN FRESH AND SEA WATER. *Bull. Jpn. Soc. Sci. Fish.* 46(3):313-317. Feb. 1980. SFA 25(3)
[Lab. Microbiol., Fac. Fish., Kagoshima Univ., Kagoshima 890, Japan]

80-002022 Sanchez, P. G. SURVIVAL POTENTIAL OF MOSQUITOFISH (*GAMBUSIA AFFINIS*) IN SALINE HABITATS. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:42-43. 30 Jan. 1980. Abstract only. SFA 25(3)
[Death Valley Natl. Monument, Death Valley, CA]

80-002023 Shuttleworth, T. J. and J. L. Thompson. OXYGEN CONSUMPTION IN THE RECTAL GLAND OF THE DOGFISH *SCYLIORHINUS CANICULA* AND THE EFFECTS OF CYCLIC AMP. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 136(1):39-43. Mar. 1980. SFA 25(3)
[Dep. Biol. Sci., Univ. Exeter, Exeter EX4 4PS, England]

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[Dep. Zool., Univ. Zululand, Private Bag, Kwa-Dlangezwa 3886, South Africa]

80-002025 Smith, M. J. and A. G. Heath. RESPONSES TO ACUTE ANOXIA AND PROLONGED HYPOXIA BY RAINBOW TROUT (*SALMO GAIRDNERI*) AND MIRROR CARP (*CYPRINUS CARPIO*) RED AND WHITE MUSCLE: USE OF CONVENTIONAL AND MODIFIED METABOLIC PATHWAYS. *Comp. Biochem. Physiol. B Comp. Biochem.* 66(2):267-272. 1980. SFA 25(3)
[Dep. Biol., Millsaps Coll., Jackson, MS 39210]

80-002026 Soivio, A.; M. Nikinmaa and K. Westman. THE BLOOD OXYGEN BINDING PROPERTIES OF HYPOXIC *SALMO GAIRDNERI*. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 136(1):83-87. Mar. 1980. SFA 25(3)

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[Div. Physiol., Dep. Zool., Univ. Helsinki, Arkadiankatu 7, SF-00100 Helsinki 10, Finland]

80-002027 Strange, R. J. and C. B. Schreck. SEAWATER AND CONFINEMENT ALTERS SURVIVAL AND CORTISOL CONCENTRATION IN JUVENILE CHINOOK SALMON. *Copeia* 1980(2):351-353. 1 May 1980. SFA 25(3)
[Dep. For. Wildl. Fish., Univ. Tenn., P.O. Box 1071, Knoxville 37901]

80-002028 Stuenkel, E. L. and S. D. Hillyard. EFFECTOS DE LA TEMPERATURA Y SALINIDAD EN EL METABOLISM ENERGETICO Y ELECTROLYTICO DEL PUPFISH, *CYPRINODON SALINUS*. [EFFECTS OF TEMPERATURE AND SALINITY ON ELECTROLYTE AND ENERGY METABOLISM IN THE PUPFISH, *CYPRINODON SALINUS*.] *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:49. 30 Jan. 1980. In English and Spanish. Abstract only. SFA 25(3)
[Univ. Nev., Las Vegas] Salt Creek pupfish, *Cyprinodon salinus*, were acclimated to freshwater (FW) and to concentrations of Salt Creek water which approximated 1/2 sea water (1/2 SW; 641 mosm/kg) and sea water (SW; 1,168 mosm/kg) at three acclimation temperatures 15, 25 and 30 C. Standard metabolic rate (VO_2) was found to increase significantly with increasing acclimation salinity although in SW, the VO_2 of 25 and 30 C acclimated fish was not different. The specific activity of gill $Na^+ - K^+$ ATPase was lowest in 1/2 SW acclimated fish at each acclimation temperature and increased two-fold with acclimation to FW or SW. The acclimation temperature also influenced gill $Na^+ - K^+$ ATPase activity with higher activity values observed in the 15° than in the 30° acclimation groups in FW and 1/2 SW. Plasma osmolality was not significantly affected by acclimation temperature in the 1/2 SW acclimated fish. In FW and SW, however, plasma osmolality decreased or increased, respectively as the acclimation temperature decreased below 30°. *C. salinus*, thus, appears to tolerate elevated salinity better at higher temperatures which correlates with the field observations that environmental salinities in Salt Creek are highest during the hot summer months.

80-002029 Tandon, R. S. and S. Chandra. ECOPHYSIOLOGY OF FISHES; EFFECT OF STARVATION ON SERUM ALKALINE PHOSPHATASE LEVELS OF FRESHWATER CATFISH *CLARIAS BATRACHUS*. *Brotéria* 48(1-4):35-38. 1979. SFA 25(3)
[Dep. Zool., Lucknow Univ., Lucknow-226007, India]

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[Inst. Biol. Med. Exp., Lab. Esteroides, Obligado 2490, Buenos Aires 1428, Argentina]

80-002031 Toneys, M. L. and D. W. Coble. MORTALITY, HEMATOCRIT, OSMOLALITY, ELECTROLYTE REGULATION, AND FAT DEPLETION OF YOUNG-OF-THE-YEAR FRESHWATER FISHES UNDER SIMULATED WINTER CONDITIONS. *Can. J. Fish. Aquatic Sci.* 37(2):225-232. Feb. 1980. In English with French summ. SFA 25(3)
[Ichthyological Assoc., Inc., 100 Smith Cass St., Middletown, DE 19709]

80-002032 Ueda, H. and H. Takahashi. RESPONSES OF TWO DIFFERENT TYPES OF PITUITARY GONADOTROPHS OF THE LOACH, *MISGURNUS ANGUILLICAUDATUS*, TO GONADECTOMY AND TO EXOGENOUS SEX STEROIDS. *Gen. Comp. Endocrinol.* 40(4):463-472. Apr. 1980. SFA 25(3)
[Dep. Biol., Fac. Fish., Hokkaido Univ., Minato-cho 3-1-1, Hokadate 041, Japan]

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80-002033 Ueda, H. CHANGES OF TWO TYPES OF PITUITARY GONADOTROPHS IN WHITESPOTTED CHAR, *SALVELINUS LEUCOMAENIS*, DURING GONADAL DEVELOPMENT. *Bull. Fac. Fish. Hokkaido Univ.* 31(1):1-15. Mar. 1980. SFA 25(3)
[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Minato-cho, Hokodate 041, Japan] In the proximal pars distalis of the pituitary gland of male and female whitespotted char, *Salvelinus leucomaenis*, two distinct types of glandular cells, termed the globular and vesicular cells, were discerned from possible thyrotrophs and somatotrophs by their locality, staining property and ultrastructure. Changes of the two types of cells were examined light and electron microscopically during the course of the first maturation and spawning of the fish. A few globular cells with immature cytoplasmic granules were already in existence in the pituitaries of one-year old fish with ovaries at the early yolk vesicle stage or with testes at the spermatogonial stage. In harmony with the subsequent development of the gonads, the globular cells showed a notable increase both in number and in size, and displayed a degranulation and a dilation of endoplasmic reticulum, followed by some atrophic changes, at the time of spawning. By contrast, the vesicular cells, which were absent in the pituitaries of immature one-year old fish, made their appearance concurrently with the appearance of oocytes in the late yolk vesicle stage or of the first spermatocytes in the gonads. They showed little change during the period of advancing vitellogenesis and spermatogenesis, but became activated again, with the development of the Golgi apparatus and the accumulation of cytoplasmic granules, 3 months after spawning when ovarian oocytes were at the late yolk vesicle stage. It was concluded that the two types of pituitary cells in the char were gonadotropic in function, each acting in different phases of gonadal development. Possible significance of the vesicular cells was discussed with respect to their implication in the initiation of vitellogenesis and spermatogenesis.

80-002034 van den Thillart, G.; F. Kesbeke and A. van Waarde. ANAEROBIC ENERGY-METABOLISM OF GOLDFISH, *CARASSIUS AURATUS* (L.). INFLUENCE OF HYPOXIA AND ANOXIA ON PHOSPHORYLATED COMPOUNDS AND GLYCOGEN. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 136(1):45-52. Mar. 1980. SFA 25(3)
[Zool. Lab., Dep. Anim. Physiol., State Univ. Leiden, Kaiserstr. 63, Leiden, The Netherlands]

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[Dep. Zool., Univ. Nijmegen, Nijmegen, The Netherlands]

80-002036 Voss, E. W., Jr.; W. J. Groberg, Jr. and J. L. Fryer. METABOLISM OF COHO SALMON Ig. CATABOLIC RATE OF COHO SALMON TETRAMERIC Ig IN SERUM. *Mol. Immunol.* 17. 445-452. 1980. SFA 25(3)
[Dep. Microbiol., Univ. Ill., Urbana 61801]

80-002037 Wahlqvist, I. and S. Nilsson. ADRENERGIC CONTROL OF THE CARDIOVASCULAR SYSTEM OF THE ATLANTIC COD, *GADUS MORHUA*, DURING "STRESS". *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 137(2):145-150. May 1980. SFA 25(3)
Dep. Zoophysiol., Univ. Göteborg, Fack, S-400 33 Göteborg, Sweden]

80-002038 Walesby, N. J. and I. A. Johnston. FIBRE TYPES IN THE LOCOMOTORY MUSCLES OF AN ANTARCTIC TELEOST, *NOTOTHENIA ROSSII*. *Cell Tissue Res.* 208(1):143-164. 1980. SFA 25(3)

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[I.A. Johnston: Dep. Physiol., Bute Med. Bldg., St. Andrews Univ., St. Andrews, Fife KY16 9TS, Scotland]

80-002039 Ware, D. M. BIOENERGETICS OF STOCK AND RECRUITMENT. *Can. J. Fish. Aquatic Sci.* 37(6):1012-1024. June 1980. In English with French summ. SFA 25(3)
[Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada]

80-002040 Wendelaar Bonga, S. E. and J. C. A. van der Meij. THE EFFECT OF AMBIENT CALCIUM ON PROLACTIN CELL ACTIVITY AND PLASMA ELECTROLYTES IN *SAROTHERODON MOSSAMBICUS (TILAPIA MOSSAMBICA)*. *Gen. Comp. Endocrinol.* 40(4):391-401. Apr. 1980. SFA 25(3)
[Dep. Zool., Univ. Nijmegen, Nijmegen, The Netherlands]

80-002041 Wiegand, M. D. and R. E. Peter. EFFECTS OF SALMON GONADOTROPHIN (SG-G100) ON PLASMA LIPIDS IN THE GOLDFISH, *CARASSIUS AURATUS*. *Can. J. Zool.* 58(6):957-966. June 1980. In English with French summ. SFA 25(3)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-002042 Wiegand, M. D. and R. E. Peter. EFFECTS OF TESTOSTERONE, OESTRADIOL-17β AND FASTING ON PLASMA FREE FATTY ACIDS IN THE GOLDFISH, *CARASSIUS AURATUS*. *Comp. Biochem. Physiol. A Comp. Physiol.* 66(2):323-326. 1980. SFA 25(3)
[R.E. Peter: Dep. Zool., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

80-002043 Wiegand, M. D. and R. E. Peter. EFFECTS OF SEX STEROIDS ON PLASMA LIPIDS IN THE GOLDFISH, *CARASSIUS AURATUS*. *Can. J. Zool.* 58(6):967-972. June 1980. In English with French summ. SFA 25(3)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-002044 Wittenberg, J. B.; D. E. Copeland; R. L. Haedrich and J. S. Child. THE SWIMBLADDER OF DEEP-SEA FISH: THE SWIMBLADDER WALL IS A LIPID-RICH BARRIER TO OXYGEN DIFFUSION. *J. Mar. Biol. Assoc. U.K.* 60(2):263-276. May 1980. SFA 25(3)
[Dep. Physiol., Albert Einstein Coll. Med., New York, NY 10461]

80-002045 Yoshii, K.; M. Kashiwayanagi; K. Kurihara and Y. Kobatake. HIGH SENSITIVITY OF THE EEL PALATINE RECEPTORS TO CARBON DIOXIDE. *Comp. Biochem. Physiol. A Comp. Physiol.* 66(2):327-330. 1980. SFA 25(3)
[K. Kurihara: Fac. Pharm. Sci., Hokkaido Univ., Sapporo, Japan]

80-002046 Zimmerer, E. J. ENVIRONMENTAL EFFECTS ON GROWTH AND FIN REGENERATION IN POECILIID FISHES. *Ph.D. dissertation, Rutger's Univ. State Univ. N.J.* 137p. 1980. From Diss. Abstr. Int. B Sci. Eng. 40(11):5173. May 1980. SFA 25(3)
Temperature, salinity, pH, food level, photoperiod, and factors associated with stunting in fishes were tested for their effect on general body growth

PHYSIOLOGY (CONTINUED)

80-002046 CONTINUED and fin regeneration in the poeciliid minnows, *Poecilia latipinna*, *P. reticulata*, and *Gambusia affinis*. In terms of general body growth, fish grew faster at an optimal temperature and had reduced growth rates above and below this point. However, regenerate growth responded to temperature in a different way, with maximum growth at the highest temperatures tolerated, and growth rate dropping with decreased temperature. Experiments testing the growth responses of these fish to fresh (.02 °/oo) versus brackish (8 °/oo) water showed *P. latipinna* to grow best in brackish water, *G. affinis* to grow best in fresh water, and *P. reticulata* to grow equally well in both conditions. *P. latipinna* and *G. affinis* showed parallel regeneration responses to these conditions, however, *P. reticulata* regenerated faster in fresh water. Food level has a direct effect on body growth of all fishes. At ration levels above maintenance fish will grow faster until maximum growth rates are achieved. Fin regeneration in *P. latipinna* and *P. reticulata* was shown to be unaffected by various ration levels above maintenance. Only at ration levels far below maintenance (starvation and prolonged near starvation) was a reduction in fin regeneration observed. *P. latipinna* responsed to increased densities with decreased body growth. Existing literature shows *P. reticulata* to respond in a similar manner. The literature also shows *P. reticulata* to grow faster with a decrease in fish number. Experiments here have shown *P. latipinna* to exhibit no differential body growth response to group size. Experiments designed to demonstrate the effect of crowding and group size as well as increased waste products in the water, the presence of larger conspecifics, and the presence of other fish species on regeneration showed no differential responses to these conditions. The photoperiods tested (24 hours light, 12 hours light/12 hours dark, and 1 hour light/23 hours dark) and pH's maintained at 8-8.5 (by NaOH, KOH, and $Ca(OH)_2$) neutral, or 5.5-6 (by peat extract) resulted in no differential response of general body growth or fin regeneration. Statistical analysis (Analysis of Covariance) has shown that the aspect of fin regeneration affected most consistently was the time necessary for wound healing and blastema formation, as represented by the Y-intercept of a linear plot of growth versus time. This aspect of fin regeneration was affected in all cases where an overall differential regeneration response was noted. The slope of the growth versus time plot represents the fin tissue growth rate after initial blastema formation. This aspect of fin regeneration was affected consistently only at the lower temperatures tested and under starvation conditions. The failure of this second aspect of fin regeneration to respond to the middle and higher temperatures indicates the possible presence of some biochemical or physiological limiting factor. This study demonstrates that fin regeneration, for the most part, responds to these environmental factors in a different way than general body growth. Therefore, when used as a short term bio-assay procedure, these differences must be taken into consideration.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-002047 Braman, J. C.; C. B. Stalnaker; G. T. Klar and T. M. Farley. HEMOGLOBIN POLYMORPHISM IN ADULT CUTTHROAT TROUT, *SALMO CLARKII*. *J. Exp. Zool.* 211(3):411-413. Mar. 1980. SFA 25(3)

[Utah Coop. Fish. Res. Unit, Utah State Univ., Logan 84322] Hemoglobin polymorphism was detected in a population of adult cutthroat trout by employing starch gel electrophoresis. Variation occurred only in the cathodally migrating hemoglobins. Six electrophoretic patterns were assumed to be present; however, the existence of a greater degree of complexity has not been ruled out. Eight of the 93 adult cutthroat trout sampled displayed a hemoglobin electrophoretic pattern identical to that obtained from adult rainbow trout.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

80-002048 Busack, C. A. and G. H. Thorgaard. KARYOTYPE OF THE SACRAMENTO PERCH, *ARCHOPLITES INTERRUPTUS*. *Calif. Fish Game* 66(3):189-191. July 1980. SFA 25(3)
[Dep. Anim. Sci., Univ. Calif., Davis 95616]

80-002049 Buth, D. G. EVOLUTIONARY GENETICS AND SYSTEMATIC RELATIONSHIPS IN THE CATOSTOMID GENUS *HYPENTELIUM*. *Copeia* 1980(2):280-290. 1 May 1980. SFA 25(3)
[Dep. Biol., Univ. Calif., Los Angeles 90024] Two or more population samples of each of the three recognized species of the tetraploid catostomid genus *Hypentelium* were subjected to electrophoretic analyses to detect isozyme variability resolving a total of 60 alleles encoded by 40 presumptive loci. Species of *Hypentelium* express only about one-third of their loci in duplicate suggesting a high level of evolutionary advancement within the Catostomidae. *Hypentelium roanokense* expresses the Ak-A and Gpi-B loci in duplicate, whereas these loci are functionally diploid in *H. etowanum* and *H. nigricans*. *Hypentelium etowanum* and *H. nigricans* are phenetically close compared to *H. roanokense*. A cladistic analysis of the genetic data reveals that *H. roanokense* exhibits numerous apomorphic allelic characteristics while *H. etowanum* and *H. nigricans* are phenetically close due to a high degree of allelic symplesiomorphy. A biochemical key to the species of the genus *Hypentelium* is provided.

80-002050 Gervai, *J.*; T. Marián; Z. Krasznai; A. Nagy and V. Csányi. OCCURRENCE OF ANEUPLOIDY IN RADIATION GYNOGENESIS OF CARP, *CYPRINUS CARPIO* L. *J. Fish Biol.* 16(4):435-439. Apr. 1980. SFA 25(3)
[Lab. Behav. Genet., Eötvös Univ., 2131 Göd Jávorka, S. u. 14, Hungary] DNA content and chromosome numbers were studied in gynogenetic and normal carp embryos. Gynogenetic embryos showed the haploid chromosome number, the occurrence of spontaneous diploidization was rare. Early cold shock treatment of the gynogenetic zygotes resulted in the retention of the second polar body producing a much higher proportion of normally developing viable larvae. The appearance of large numbers of aneuploid embryos in the cold-treated gynogenetic group is explained by the loss or breakdown of chromosomes that are caused in their turn by the absorbtion of the second polar body through the cold treatment.

80-002051 Hulata, G.; R. Moav and G. Wohlfarth. GENETIC DIFFERENCES BETWEEN THE CHINESE AND THE EUROPEAN RACES OF THE COMMON CARP III. GONAD ABNORMALITIES IN HYBRIDS. *J. Fish Biol.* 16(4):369-370. Apr. 1980. SFA 25(3)
[Agric. Res. Organ., Inst. Anim. Sci., Fish Aquacult. Res. Stn., Dor, Israel]

80-002052 Imhof, M.; R. Leary and H. E. Booke. POPULATION OR STOCK STRUCTURE OF LAKE WHITEFISH, *COREGONUS CLUPEAFORMIS*, IN NORTHERN LAKE MICHIGAN AS ASSESSED BY ISOZYME ELECTROPHORESIS. *Can. J. Fish. Aquatic Sci.* 37(5):783-793. May 1980. In English with French summ. SFA 25(3)
[Lab. Limnol., Univ. Wis., Madison 53706]

80-002053 Jamieson, A. and R. J. Turner. MUSCLE PROTEIN DIFFERENCES IN TWO EELS *ANGUILLA ANGUILLA* (LINNAEUS) AND *ANGUILLA ROSTRATA* (LE SEUER). *Biol. J. Linn. Soc.* 13(1):41-45. Feb. 1980. SFA 25(3)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, NR33 0HT, England]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

80-002054 LeGrande, W. H. and T. M. Cavender. THE CHROMOSOME COMPLEMENT OF THE STONECAT MADTOM, *NOTURUS FLAVUS* (SILURIFORMES: ICTALURIDAE), WITH EVIDENCE FOR THE EXISTENCE OF A POSSIBLE CHROMOSOMAL RACE. *Copeia* 1980(2):341-344. 1 May 1980. SFA 25(3)
[Dep. Biol., Univ. Wis., Stevens Point 54481]

80-002055 Loudenslager, E. J. and G. A. E. Gall. GEOGRAPHIC PATTERNS OF PROTEIN VARIATION AND SUBSPECIATION IN CUTTHROAT TROUT, *SALMO CLARKI*. *Syst. Zool.* 29(1):27-42. Mar. 1980. SFA 25(3)
[Dep. Anim. Sci., Univ. Calif., Davis 95616] Genetic differentiation and the evolutionary relationships among 30 populations, representing five subspecies of inland cutthroat trout, *Salmo clarki* (Richardson), were studied by examining geographic variation at 35 genetic loci assayed with starch gel electrophoresis. Analysis of population subdivision using Nei's H_s, H_t, and G_{st} statistics, indicated low genetic variability within, and extreme genetic subdivision among subspecies inhabiting independent basins and drainages. Substantial subdivision was also observed for isolated populations within the Lahontan Basin. UPGMA and Wagner clustering analysis indicated that inland *S. clarki* can be subdivided into three major groups: 1) *S. c. utah*, *S. c. pleuriticus*, and *S. c. bouvieri* constitute a subspecies complex that inhabits drainages of the Bonneville Basin, Colorado River, Upper Snake River, and the Yellowstone River; 2) *S. c. henshawi*, a subspecies inhabiting the Lahontan Basin; and 3) *S. c. lewisi*, a widely dispersed group inhabiting the Upper Columbia and Upper Missouri River drainages. *Salmo c. henshawi* is closely related to the *utah-pleuriticus-bouvieri* complex whereas *lewisi* is electrophoretically distinct and not closely related to the other four inland subspecies. These results are concordant with chromosomal analysis and topographical changes in Western North America.

80-002056 Murofushi, M.; S. Oikawa; S. Nishikawa and T. H. Yosida. CYTOGENETICAL STUDIES ON FISHES, III. MULTIPLE SEX CHROMOSOME MECHANISM IN THE FILEFISH, *STEPHANOLEPIS CIRRHIFER*. *Jpn. J. Genet.* 55(2):127-132. Apr. 1980. SFA 25(3)
[Lab. Biol., Fac. Mishima Junior Coll., Nihon Univ., Mishima 411, Japan]

80-002057 NUCLEAR TRANSPLANTATION IN TELEOSTS. I. HYBRID FISH FROM THE NUCLEUS OF CARP AND THE CYTOPLASM OF CRUCIAN. *Sci. Sin.* 23(4):517-525. Apr. 1980. SFA 25(3)
Hybrid fish are obtained from the combination of nucleus and cytoplasm from different genera of fresh-water teleosts using the technique of nuclear transplantation, i.e. by combining nucleus of the carp (*Cyprinus carpio*) and cytoplasm of the crucian (*Carassius auratus*). Morphological characteristics of these hybrid fish show that some features are inherited from the nucleus doner fish such as barbs and pharyngeal teeth, some seem to come from the cytoplasm host fish such as the number of vertebrae, and some are intermediates such as the number of scales along the lateral line. These results indicate that both nucleus and cytoplasm can influence the expression of genetic information on the hybrid fish. Some of the hybrid fish are sexually mature and can produce normal offspring by artificial insemination.

80-002058 Schultz, R. J. ROLE OF POLYPLOIDY IN THE EVOLUTION OF FISHES. IN W. H. Lewis, ed. *Polyploidy: Biological Relevance*. Plenum Publ. Corp., New York, NY. p. 313-340. 1980. SFA 25(3)
[Ecol. Sect., Biol. Sci. Group, Univ. Conn., Storrs 06268]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

80-002059 Smith, P. J.; G. J. Patchell and P. G. Benson. GLUCOSEPHOSPHATE ISOMERASE AND ISOCITRATE DEHYDROGENASE POLYMORPHISMS IN THE HAKE, *MERLUCCIUS AUSTRALIS*. *N.Z. J. Mar. Freshwater Res.* 13(4):545-547. 1979. SFA 25(3)

[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19062, Wellington, New Zealand] As part of a stock separation programme on the hake, *Merluccius australis* (Hutton), two polymorphic proteins--glucosephosphate isomerase and isocitrate dehydrogenase--were examined in four samples of fish from around the South Island of New Zealand and the waters to the south. No significant differences in allele frequencies were found between the four areas, and with evidence from biological data it appears that there is one major stock of *M. australis* around New Zealand.

BEHAVIOR

80-002060 Døving, K. B.; R. Selset and G. Thommesen. OLFACTORY SENSITIVITY TO BILE ACIDS IN SALMONID FISHES. *Acta Physiol. Scand.* 108(2):123-131. Feb. 1980. SFA 25(3)

[Inst. Zoophysiol., Univ. Oslo, Norway] Monopolar DC-recordings were made simultaneously from two positions on the olfactory bulb of chars (*Salmo alpinus* L.) and graylings (*Thymallus thymallus* L.) using bile acids and amino acids as olfactory stimulants. The bile acids induced responses with characteritic spatial differences from those of the amino acids. The distribution of responses to bile acids indicated a neuronal activity in the medial part of the bulb. In contrast, amino acids elicit responses in the lateral part of the bulb. Taurine conjugated bile acids were up to 1,000 times more potent as olfactory stimuli than methionine. The results suggest that olfactory receptors are of two types, one responding to bile acids, the other to amino acids. 3-α-hydroxysteroids are released from the fish into the water in quantities that suffice for detection by their olfactory system. The odorant potency of the bile acids, their evolutionary history and variability, together with their renowned adherent properties made them interesting candidates for specific signals in the aquatic environment.

80-002061 Baker, C. L., Jr. JAMMING AVOIDANCE BEHAVIOR IN GYMNOTOID ELECTRIC FISH WITH PULSE-TYPE DISCHARGES: SENSORY ENCODING FOR A TEMPORAL PATTERN DISCRIMINATION. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 136(2):165-181. Mar. 1980. SFA 25(3)

[Dep. Neurosci., A-002 U.S.S.D., La Jolla, CA 92093]

80-002062 Bechler, D. L. THE EVOLUTION OF AGONISTIC BEHAVIOR IN AMBLYOPSID FISHES. *Trans. Mo. Acad. Sci.* 13:177. 1979. Abstract only. SFA 25(3)

[Dep. Biol., St. Louis Univ., St. Louis, MO 63103]

80-002063 Beecher, H. A. HABITAT SEGREGATION OF FLORIDA CARPSUCKERS (OSTEICHTHYES: CATOSTOMIDAE: *CARPIODES*). *Fla. Sci.* 43(2):92-97. 1980. SFA 25(3)

[Wash. Nat. Heritage Prog., Nature Conservancy, Bldg. 17, Air-Industrial Cent., Olympia, WA 98504] *Carpiodes cyprinus* and *C. velifer* were captured with a boat-mounted electrofishing apparatus in various habitats in the Escambia and Choctawhatchee rivers, and *C. cyprinus* was similarly captured in the Apalachicola River. There was much overlap in habitat, but in the Escambia River *C. cyprinus* occurred in mid-river more than would have been expected had the 2 species of carpsuckers been similarly distributed. *Carpiodes cyprinus* was concentrated in mid-river in late summer and early fall during low water in all 3 rivers, and during high

BEHAVIOR (CONTINUED)

80-002063 CONTINUED water *C. cyprinus* occupied areas of reduced current. On the other hand, *C. velifer* occupied areas of reduced current in the Escambia and Choctawhatchee rivers throughout the year.

80-002064 Blake, R. W. THE MECHANICS OF LABRIFORM LOCOMOTION. II. ANALYSIS OF THE RECOVERY STROKE AND THE OVERALL FIN-BEAT CYCLE PROPULSIVE EFFICIENCY IN THE ANGELFISH. *J. Exp. Biol.* 85:337-342. Apr. 1980. SFA 25(3)
[Dep. Zool., Univ. British Columbia, Wesbrook Mall, Vancouver VT6 1W5, Canada]

80-002065 Boer, B. A. de. A CAUSAL ANALYSIS OF THE TERRITORIAL AND COURTSHIP BEHAVIOUR OF *CHROMIS CYANEA* (POMACENTRIDAE, PISCES). *Behaviour* 73(1-2):1-50. 1980. SFA 25(3)
[Caribbean Mar. Biol. Inst., Curacao, Netherlands Antilles]

80-002066 Buckingham, S. W. and L. Rigley. AGONISTIC BEHAVIOR IN THE TEXAS CICHLID, *CICHLASOMA CYANOGUTTATA*. *Proc. Pa. Acad. Sci.* 53(2):151-155. 1979. SFA 25(3)
[Dep. Biol., Wilkes Coll., Wilkes-Barre, PA 18703] The Texas Cichlid, *Cichlasoma cyanoguttata*, being a substrate spawner, was shown to demonstrate predictable behavior during agonistic encounters with conspecifics in the presence of a shelter. Agonistic behaviors included color pattern variations, fin displays, and body displays. A "ratchet" sound was produced in conjunction with one body display and a hydrodynamic "whoofing" sound was regularly spaced between repetitions of a second body display.

80-002067 Casterlin, M. E. and W. W. Reynolds. DIEL ACTIVITY OF THE BLUESPOTTED SUNFISH *ENNEACANTHUS GLORIOSUS*. *Copeia* 1980(2):344-345. 1 May 1980. SFA 25(3)
[Mar. Biol. Prog., Univ. New England, Biddeford, ME 04005]

80-002068 Colgan, P. and N. Costeloe. PLASTICITY OF BURYING BEHAVIOR BY THE BANDED KILLIFISH, *FUNDULUS DIAPHANUS*. *Copeia* 1980(2):349-351. 1 May 1980. SFA 25(3)
[Biol. Dep., Queen's Univ., Kingston, ON K7L 3N6, Canada]

80-002069 Ebbesson, S. O. E. and D. L. Meyer. THE VISUAL SYSTEM OF THE GUITAR FISH (*RHINOBATOS PRODUCTUS*). *Cell Tissue Res.* 206(2):243-250. Mar. 1980. SFA 25(3)
[D. L. Meyer: Inst. Histol. Neuroanat., Kreuzbergring 36, 3400 Göttingen, West Germany]

80-002070 Godin, J.-G. J. DIEL RHYTHMS OF BEHAVIOR IN JUVENILE PINK SALMON (*ONCORHYNCHUS GORBUSCHA* WALBAUM). *Ph.D. dissertation, Univ. British Columbia* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5168. May 1980. SFA 25(3)

80-002071 Grossman, G. D. FOOD, FIGHTS, AND BURROWS: THE ADAPTIVE SIGNIFICANCE OF INTRASPECIFIC AGGRESSION IN THE BAY GOBY (PISCES: GOBIIDAE). *Oecologia (Berl.)* 45(2):261-266. 1980. SFA 25(3)
[Dep. Wildl. Fish. Biol., Univ. Calif., Davis 95616] The effects of size, sex, bout initiation, past experience, and prior residence were examined with respect to the outcome of intraspecific agonistic contests in the bay

BEHAVIOR (CONTINUED)

80-002071 CONTINUED goby (*Lepidogobius lepidus*). In addition, the adaptive significance of this behavior was examined by investigating the relationship between dominance and access to two potentially limiting resources; food and the burrows of invertebrate symbionts. For heterosexual and male homosexual contests, size and initiation significantly affected bout outcome. Gender did not affect heterosexual encounters. In female homosexual bouts initiation played a significant role in determining contest outcome while size did not. Both past experience and prior residency had significant effects on the outcome of intraspecific encounters. Dominant gobies had increased access to simulated invertebrate burrows and limited food. It appears that intraspecific aggression is an adaptive phenomenon through which access to limiting resources may be mediated.

80-002072 Hanes, S. R. and R. J. Stark. REESTABLISHMENT OF RETINAL-TECTAL SPECIFICITY DURING GOLDFISH OPTIC NERVE REGENERATION. *Proc. Indiana Acad. Sci.* 88:425. 1979. Abstract only. SFA 25(3)
[Dep. Biol., Indiana Univ.-Purdue Univ., Indianapolis, IN 46205]

80-002073 Hopkins, C. D. EVOLUTION OF ELECTRIC COMMUNICATION CHANNELS OF MORMYRIDS. *Behav. Ecol. Sociobiol.* 7(1):1-13. 1980. SFA 25(3)
[Dep. Ecol. Behav. Biol., Univ. Minn., Minneapolis 55455]

80-002074 Horner, K.; O. Sand and P. S. Enger. BINAURAL INTERACTION IN THE COD. *J. Exp. Biol.* 85:323-331. Apr. 1980. SFA 25(3)
[Mar. Lab., Aberdeen, Scotland]

80-002075 Johansen, P. H. and J. A. Cross. EFFECTS OF SEXUAL MATURATION AND SEX STEROID HORMONE TREATMENT ON THE TEMPERATURE PREFERENCE OF THE GUPPY, *POECILIA RETICULATA* (PETERS). *Can. J. Zool.* 58(4):586-588. Apr. 1980. In English with French summ. SFA 25(3)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada] In a horizontal temperature gradient, male guppies prefer a significantly lower temperature (24.5°C) than females (28.2°C) or juveniles (28.1°C). Treatment of juveniles and females with testosterone lowers their preferred temperatures to that of males. The reduction in the preferred temperature of testosterone-treated juveniles can occur without the development of male secondary sexual characters. Estrogen treatment of juveniles is without effect, as is treatment of males with estrogen or testosterone. It is postulated that testosterone acts at a level of the hypothalamic thermoregulatory centre.

80-002076 Kavaliers, M. CIRCADIAN LOCOMOTOR ACTIVITY RHYTHMS OF THE BURBOT, *LOTA LOTA*: SEASONAL DIFFERENCES IN PERIOD LENGTH AND THE EFFECT OF PINEALECTOMY. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 136(3):215-218. 1980. SFA 25(3)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] The burbot, *Lota lota*, displayed a free-running circadian locomotor activity rhythm under constant darkness. There was a seasonal change in the length of the circadian period (τ). Fish captured during winter had a mean τ of 21.2 ± 0.30 h as oposed to a τ of 23.5 ± 0.25 in summer. Removal of the pineal organ had significant effects on the length and stability of the circadian period. Furthermore, the pineal influences on period length varied with season. In winter, τ was significantly lengthened (22.1 ± 0.30 h to 23.4 ± 0.50 h) while in summer, τ was significantly shortened (23.5 ± 0.25 h to 21.9 ± 0.50 h).

BEHAVIOR (CONTINUED)

80-002077 Kerebel, L.-M. and M.-T. Le Cabellec. ENAMELOID IN THE TELEOST FISH *LOPHIUS*. *Cell Tissue Res.* 206(2):211-223. Mar. 1980. In English with French summ. SFA 25(3)
[Fac. Chir. Dent., F.R.A. 35 INSERM, Nantes, France]

80-002078 Konagaya, T. [RESPONSE OF FISH TO LOW-FREQUENCY SOUND.] *Bull. Jpn. Soc. Sci. Fish.* 46(2):125-128. Feb. 1980. In Japanese with English summ. SFA 25(3)
[Fac. Fish., Mie Univ., Edobashi, Tsu 514, Japan] Fish are considered to generate extremely low frequency sound by the motion of the fin or body in water, and to use this sound for mutual communication in schooling. This means that fish may be able to perceive the low-frequency sound produced by the motion of objects in water. This paper deals with the very low-frequency underwater sound produced by the motion of fish and fishing gears in water and the responses of the fish to this sound. Results obtained are summarized as follows: 1) Fish and fishing gears produce short pulses by their motion in water. 2) A rapid pressure change was detected at the net mouth of a wingless model dragnet. 3) The fish responds by rapid swimming or tail flipping to the pulsy sound or the pressure change in water.

80-002079 Konagaya, T. [THE SOUND FIELD OF LAKE BIWA AND THE EFFECTS OF THE CONSTRUCTING SOUND ON THE BEHAVIOR OF THE FISH.] *Bull. Jpn. Soc. Sci. Fish.* 46(2):129-132. Feb. 1980. In Japanese with English summ. SFA 25(3)
[Fac. Fish., Mie Univ., Edobashi, Tsu 514, Japan] In order to clarify the effects of construction sound to fish populations, the change of acoustic environments of Lake Biwa by dredging was observed. Also, the response of fish to dredging sound and swimming direction of fish near the worksite was studied by the use of acoustic biotelemetry. Results obtained are summarized as follows: 1) The spectrum level of the back ground noise of Lake Biwa was within the limits of prevailing noise of the sea. 2) Pressure level of the underwater sound of a dredging boat at a distance of 150 m was about 38 dB, and that of a submerged pipe at a distance of 2 m was 75 dB. The fish showed negative responses and was considered to avoid the acoustic field of worksite.

80-002080 Laming, P. R. and G. E. Savage. PHYSIOLOGICAL CHANGES OBSERVED IN THE GOLDFISH (*CARASSIUS AURATUS*) DURING BEHAVIORAL AROUSAL AND FRIGHT. *Behav. Neural Biol.* 29(2):255-275. June 1980. SFA 25(3)
[Dep. Zool., Queen's Univ. Belfast, Belfast BT7 1NN, Northern Ireland]

80-002081 Luckner, C. L. MORPHOLOGICAL AND BEHAVIORAL POLYMORPHISM IN *POECILIA LATIPINNA* MALES (PISCES: POECILIIDAE). *Ph.D. dissertation, La. State Univ. Agric. Mech. Coll.* 88p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5572. June 1980. SFA 25(3)

80-002082 Malmqvist, B. HABITAT SELECTION OF LARVAL BROOK LAMPREYS (*LAMPETRA PLANERI*, BLOCH) IN A SOUTH SWEDISH STREAM. *Oecologia (Berl.)* 45(1):35-38. 1980. SFA 25(3)
[Dep. Anim. Ecol., Univ. Lund, S-22362 Lund, Sweden] The burrowing larvae of the brook lamprey *Lampetra planeri* (Bloch) were shown by discriminant analysis to inhabit stream sites having certain qualities. Although a few larvae occurred in far-from-optimal habitats, most larvae selected those with low current velocity, low water depth, a low number of particles in the 0.5-1 mm range, and with low chlorophyll α content. Other factors normally positively attributed to larval lamprey distribution such as organic content, shade, and presence of algae did not improve the discriminant model. The last factor even showed a negative correlation.

BEHAVIOR (CONTINUED)

80-002082 CONTINUED Stream bed stability was considered to be of great importance although it was not possible to estimate quantitatively.

80-002083 McCleave, J. D. SWIMMING PERFORMANCE OF EUROPEAN EEL (*ANGUILLA ANGUILLA* (L.)) ELVERS. *J. Fish Biol.* 16(4):445-452. SFA 25(3)
[Dep. Biol., Univ. Me., Orono 04469] To determine the relation between swimming endurance time and burst swimming speed, elvers of the European eel, *Anguilla anguilla* (L.) were made to swim at speeds from 3.6 to 7.2 L (body lengths)/s in both fresh and sea water. Swimming endurance time of elvers averaging 7.2 cm total length decreased logarithmically with increased swimming speed from 3.0 min at 3.5 L/s to 0.7 min at 5.0 L/s, and again logarithmically but with a lesser slope to 0.27 min at 7.5 L/s. No differences were found between fresh and sea water elvers. In still water, elvers could swim at high speeds for about 10-45m before exhaustion, depending upon speed. Elvers would be able to make virtually no progress against water currents >50 cm/s. Drift in coastal water currents and selective tidal transport probably involve swimming speeds below those tested in this study. Migration into freshwater streams undoubtedly involves avoidance of free stream speeds and a combination of burst and sustained swimming.

80-002084 McKaye, K. R. SEASONALITY IN HABITAT SELECTION BY THE GOLD COLOR MORPH OF *CICHLASOMA CITRINELLUM* AND ITS RELEVANCE TO SYMPATRIC SPECIATION IN THE FAMILY CICHLIDAE. *Environ. Biol. Fishes* 5(1):75-78. 30 Jan. 1980. SFA 25(3)
[Dep. Biol., Yale Univ., New Haven, CT 06520]

80-002085 Meliska, C. J.; J. A. Meliska and H. V. S. Peeke. THREAT DISPLAYS AND COMBAT AGGRESSION IN *BETTA SPLENDENS* FOLLOWING VISUAL EXPOSURE TO CONSPECIFICS AND ONE-WAY MIRRORS. *Behav. Neural Biol.* 28(4):473-486. Apr. 1980. SFA 25(3)
[Psychol. Dep., Monmouth Coll., Monmouth, IL 61462]

80-002086 Melisky, E. L.; J. R. Stauffer, Jr. and C. H. Hocutt. TEMPERATURE PREFERENCE OF BANDED KILLIFISH, *FUNDULUS DIAPHANUS*, FROM SOUTHWESTERN PENNSYLVANIA. *Copeia* 1980(2):346-349. 1 May 1980. SFA 25(3)
[Appalachia Environ. Lab., Univ. Md., Frostburg 21532]

80-002087 Nashimoto, K. [THE SWIMMING SPEED OF FISH IN RELATION TO FISH SIZE AND FREQUENCY OF TAIL BEATING.] *Bull. Jpn. Soc. Sci. Fish.* 46(3):307-312. Feb. 1980. In Japanese with English summ. SFA 25(3)
[Fac. Fish., Hokkaido Univ., Minato-cho, Hokodate 041, Japan]

80-002088 Neproshin, A. Yu.; O. N. Kruchinin and A. S. Fedoseyenkov. THE ACOUSTIC BEHAVIOR OF THE POND SMELT, *HYPOMESUS OLIDUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):167-169. 1979. SFA 25(3)
[TINRO, Vladivostok, USSR]

80-002089 Partridge, B. L.; T. Pitcher; J. M. Cullen and J. Wilson. THE THREE-DIMENSIONAL STRUCTURE OF FISH SCHOOLS. *Behav. Ecol. Sociobiol.* 6(4):277-288. Mar. 1980. SFA 25(3)
[Dep. Biol., Univ. Miami, Coral Gables, FL 33124]

BEHAVIOR (CONTINUED)

80-002090 Proctor, C.; P. R. L. Mosse and R. C. L. Hudson. A HISTOCHEMICAL AND ULTRASTRUCTURAL STUDY OF THE DEVELOPMENT OF THE PROPULSIVE MUSCULATURE OF THE BROWN TROUT, *SALMO TRUTTA* L., IN RELATION TO ITS SWIMMING BEHAVIOUR. *J. Fish Biol.* 16(3):309-329. Mar. 1980. SFA 25(3)

[Dep. Zool., Univ. Melbourne, Parkville, Victoria, Australia] The differentiation of the myotomal muscle types in the propulsive musculature of *Salmo trutta* has been investigated histochemically and ultrastructurally from the late embryonic to the free-swimming fish at 5 1/2 months post fertilisation and related to observed changes in swimming behaviour. A histochemical and ultrastructural characterisation was also made of the major myotomal muscle fibre types in fingerling and yearling, *S. trutta*. Two distinct populations of muscle cells types can be recognised prior to hatching. The early development of the white fibre population is related to the short, burst-type swimming activity at early stages. The later increase in the development of the red fibre population is directly related to the appearance of sustained swimmming activity. The swimming performance of free-swimming alevins has been investigated and the results are discussed in comparison to adult fish.

80-002091 Quinn, T. P. EVIDENCE FOR CELESTIAL AND MAGNETIC COMPASS ORIENTATION IN LAKE MIGRATING SOCKEYE SALMON FRY. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 137(3):243-248. 1980. SFA 25(3)

[Coll. Fish. WH-10, Univ. Wash., Seattle 98195] Radially symmetrical, four-armed tanks were designed for testing the directional preferences of sockeye salmon (*Oncorhynchus nerka*) fry as they commenced up-lake migrations following emergence from gravel nests and river migration to the lake. When tested during the day or night, as appropriate for their migration, fry from two different stocks moved in compass directions corresponding to the directions which they would have to maintain in their up-lake migration. The directional preferences of one population tested during the non-migratory time of day apparently corresponded to the fry's onshore movement. Orientation was maintained under both overcast and clear skies, and under plastic covers as well. A 90° counter-clockwise shift in the horizontal component of the earth's magnetic field was associated with approximately 90° changes in the mean direction of movement of fry at night, even when they were given a view of the sky. During the day, only fish tested in covered tanks displayed redirected movements in the altered field; those tested with a view of the sky showed geographically appropriate movement patterns despite the shifted field.

80-002092 Quinn, T. P. LOCOMOTOR RESPONSES OF JUVENILE BLIND CAVE FISH, *ASTYANAX JORDANI*, TO THE ODORS OF CONSPECIFICS. *Behav. Neural Biol.* 29(1):123-127. May 1980. SFA 25(3)

[Coll. Fish., Univ. Wash., Seattle 98195] Juvenile blind cave fish, *Astyanax jordani*, were tested for locomotor behavior responses to the chemical traces of conspecifics. The fish spent more time in the end of a tank previously occupied by cave fish than in the unoccupied end. There was significant variation in the attraction responses, but no fish were more "attractive" than others. Locomotor activity was reduced in the presence of a conspecific's odors. However, the magnitude of the localized, reduced swimming response was low. It is hypothesized that the aggregation tendency is maintained as a vestige in cave populations by hybridization with the schooling river fish, *A. mexicanus*, from which they apparently evolved.

80-002093 Rechten, C. BROOD RELIEF BEHAVIOUR OF THE CICHLID FISH *ETROPLUS MACULATUS*. *J. Comp. Ethol.* 52(1):77-102. 1980. SFA 25(3)

[Max Planck Inst. Verhaltensphysiol., Seewiesen, West Germany] Quantitative recordings were made of the behaviour of *Etroplus maculatus* parents caring for eggs and wrigglers. Spatial and temporal aspects of brood relief behaviour are examined in connection with parent size, time of

BEHAVIOR (CONTINUED)

80-002093 CONTINUED day, interval since spawning and the frequencies of occurrence of other behaviours. Functional aspects of Cichlid brood relief behaviour are discussed and compared with those of avian nest relief.

80-002094 Rigley, L. and J. Muir. THE ROLE OF SOUND PRODUCTION BY THE BROWN BULLHEAD *ICTULURUS NEBULOSUS*. *Proc. Pa. Acad. Sci.* 53(2):132-134. 1979. SFA 25(3)

[Dep. Biol., Wilkes Coll., Wilkes-Barre, PA 18766] The brown bullhead, *Ictalurus nebulosus*, was found to produce sound during agressive conspecific encounters. The sound was in the form a a "rachet" sound and when recorded sounds were played back to conspecific resident and intruder fishes, there was a decrease in the number of aggressive encounters and an increase in the duration of time between the playback sound and the first encounter.

80-002095 Scarfe, A. D. SPONTANEOUS LOCOMOTOR BEHAVIOR OF GOLDFISH (*CARASSIUS AURATUS*) AND LEMON SHARKS (*NEGAPRION BREVIROSTRIS*) IN RESPONSE TO DIFFERENT VISUAL CONFIGURATIONS. *Ph.D. dissertation, Tex. A&M Univ.* 176p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5575. June 1980. SFA 25(3)

80-002096 Scott, D. B. C. and C. E. Currie. SOCIAL HIERARCHY IN RELATION TO ADRENOCORTICAL ACTIVITY IN *XIPHOPHORUS HELLERI* HECKEL. *J. Fish Biol.* 16(3):265-277. Mar. 1980. SFA 25(3)

[Zool. Dep., Univ. St. Andrews, Scotland] A study of the epideictic behaviour patterns of male *Xiphophorus helleri* Heckel was made, and the social rank of individual fish in 12 groups of three was assessed over a ten-day period. Straight-line hierarchies were established in most groups. An anatomical study was made to locate the adrenocortical tissue, and the adrenocoritcal activity of each fish was assessed by measuring mean nuclear diameter of 25 adrenocortical cells. Although results were somewhat variable, the highest-ranking fish in 7 out of 12 groups showed the least adrenocortical activity. The remaining two fish showed no significant difference from each other in adrenocortical activity, though their rank was in most cases clearly distinguishable on behavioural grounds.

80-002097 Selset, R. and K. B. Døving. BEHAVIOUR OF MATURE ANADROMOUS CHAR (*SALMO APINUS* L.) TOWARDS ODORANTS PRODUCED BY SMOLTS OF THEIR OWN POPULATION. *Acta Physiol. Scand.* 108(2):113-122. Feb. 1980. SFA 25(3)

[Inst. Zoophysiol., Univ. Oslo, Norway] Mature anadromous char (*Salmo alpinus* L.) of a specific population were tested in behaviour experiments with respect to attraction effects of smolts of the same population, smolt material, and chemical fractions of that material. The char reaction indicated preferences for intestinal contents and possibly bile from own population over skin mucus material and food. Chemical fractions isolated from the intestinal contents were tested for attraction at a concentration of $1.5 \times 1/10^9$ g per l. One of the fractions attracted the mature char. The results are discussed in relation to the "migration pheromone" hypothesis proposed by Nordeng (1971) as being crucial for the return of anadromous salmonids to their home river's spawning grounds.

LIFE HISTORY-GENERAL WORKS

80-002098 Anderson, R. M. THE DISTRIBUTION AND ASPECTS OF THE LIFE HISTORY OF *MEDA FULGIDA* IN NEW MEXICO. *Summ. Proc. Annu. Symp. Desert Fish.*

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002098 CONTINUED *Counc.* 10:30. 30 Jan. 1980. Abstract only. SFA 25(3)
[N. Mex. State Univ., University Park]

80-002099 DeMartini, E. E. and M. E. Anderson. COMPARATIVE SURVIVORSHIP AND LIFE HISTORY OF PAINTED GREENLING (*OXYLEBIUS PICTUS*) IN PUGET SOUND, WASHINGTON AND MONTEREY BAY, CALIFORNIA. *Environ. Biol. Fishes* 5(1):33-47. 30 Jan. 1980. SFA 25(3)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara] The painted greenling, *Oxylebius pictus*, a hexagrammid fish of shallow, northeastern Pacific rocky habitats was observed and collected near the center of its range at Monterey Bay, California, and near the northern limit of its distribution at Puget Sound. Life history characteristics were compared for breeding stocks from the two areas. Mean and maximum adult body sizes (lengths and wet weights) and longevities of both sexes are greater at Puget Sound. Also, both males and females reach sexual maturity at a smaller body length at Monterey. Age group 0 and 1 juveniles are twice as abundant as adults at Monterey but rare at Puget Sound. Monterey females have greater relative fecundities. Egg development rates are similar at equivalent temperatures; eggs are smaller, however, at Monterey, and thus embryos are smaller at hatching. Length increase is faster for Puget Sound juveniles; adult fish in two areas grow in length at comparable rates, although weight per body length is consistently greater for Monterey fish. These findings reflect a poorer survivorship at Monterey, where natural predation on fertilized eggs and the mortality rates of adult males are greater.

80-002100 Druzhinin, A. D. and N. A. Filatova. SOME DATA ON *PLECTORHINCHUS PICTUS* OF THE FAMILY POMADASYIDAE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):154-155. 1979. SFA 25(3)
[VNIRO, Moscow, USSR]

80-002101 Gaygalas, K. S. ECOLOGICAL PECULIARITIES AND FISHERIES SIGNIFICANCE OF THE SICHEL, *PELECUS CULTRATUS*, IN THE COURLAND LAGOON BASIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):74-81. 1979. SFA 25(3)
[Inst. Zool. Parasitol., Lithuanian SSR Acad. Sci., Vilnius, USSR] The distribution, growth, condition factor, spawning, fecundity and population structure of the sichel, *Pelecus cultratus*, in Courland Lagoon were studied. The selectivity of various types of fishing gear and features of sichel fishing during separate fishing periods in this bay are examined.

80-002102 Hempel, G. EARLY LIFE HISTORY OF MARINE FISH. *Wash. Sea Grant Publ., Univ. Wash. Press, Seattle* xvi + 70p. 1979. SFA 25(3)

80-002103 Ismukhanov, Kh. K. MORPHOECOLOGICAL CHARACTERISTICS OF THE EASTERN BREAM, *ABRAMIS BRAMA ORIENTALIS*, ACCLIMATIZED IN BUKHTARMA RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):38-48. 1979. SFA 25(3)
[Altay Dep., Kazakh Fish. Res. Inst., Ust'-Kamenogorsk, USSR]

80-002104 Messieh, S. N. A BIBLIOGRAPHY OF HERRING (*CLUPEA HARENGUS* L.) IN THE NORTHWEST ATLANTIC. *Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep.* No. 919. iii + 25p. Jan. 1980. In English with French summ. SFA 25(3)
[Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002105 Minckley, C. O. RECOVERY OF THE HUMPBACK CHUB, *GILA CYPHA*, AND OBSERVATIONS ON THAT SPECIES, 1977-1978. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:40. 30 Jan. 1980. Abstract only. SFA 25(3)
[Biol. Dep., Mus. North. Ariz., Flagstaff] During 1978, twenty adult humpback chubs were placed at Willow Beach National Fish Hatchery, for propagation purposes. The fish were collected from the Little Colorado River, in the vicinity of its mouth, flown to the south rim of the Grand Canyon, and transported to Willow Beach. All fish arrived in good condition and were in the hatchery raceways within five hours of lift-off from the Little Colorado River. During 1978, 555 humpback chubs were collected. Of these fish, 21.5% (196) were juveniles, and 78.5% (359) were adults. Distribution of this species within the mainstream Colorado River was extended to river mile 194, based on a report from a commercial river runner. General distribution within the system reflects the size of fish, with larger adults preferring water over two meters in depth. Juvenile fish occurred in water less than two meters in depth. Both size groups were usually found in moderate to slow current over silt-sand bottom in the Little Colorado River. Schooling was observed both in adult and juvenile humpback chubs, as was feeding behavior. Schooling fish were observed feeding both on the bottom substrate and the surface film. Adult chubs were observed to take *Cladophora* sp. as well as food from commercial river parties. The stomachs of three young-of-the-year humpback chubs were found by direct examination to contain dipteran Families of Chironomidae, Ceratopogonidae and Dolichopodidae. Reproduction appeared to have occurred in early June based on the small size of the fish collected by seining (mean T. L. = 19 mm). It is suspected that spawning commences in early spring (March) and continues through early summer, as observed. Estimated numbers of humpback chubs, based on seining collections, ranged from 122 fish/hectare in May up to 1527 fish/hectare in June. Tagging operations were also implemented in July of 1978 using 3/8" x 1/8" fingerling tags. To date, 120 humpback chubs have been tagged and none have been recaptured. Major problems faced by this population of humpback chubs are human impact, water fluctuations, and a newly discovered infestation of the anchorworm parasite *Learnea* sp. During October, 54% of the chubs collected were infested.

80-002106 Relyea, K.; T. Vaughan and J. Ferguson. NOTES ON *PSEUDOCHROMIS* RÜPPEL 1835 IN THE NORTHERN ARABIAN GULF. *Senckenbergiana Biol.* 60(3/4):141-146. 1980. SFA 25(3)
[Biol. Dep., Jacksonville Univ., Jacksonville, FL 32211]

80-002107 Sahrhage, D. and R. Schöne. BIOLOGISCHE UNTERSUCHUNGEN AM BLAUEN WITTLING (*MICROMESISTIUS POUTASSOU*) IM NORDOSTATLANTIK. [BIOLOGICAL INVESTIGATIONS ON THE BLUE WHITING (*MICROMESISTIUS POUTASSOU*) IN THE NORTHEAST ATLANTIC.] *Arch. Fischereiwiss.* 30(2-3):81-120. Mar. 1980. In German with English summ. SFA 25(3)
[Inst. Seefisch. Bundesforschungsanst. Fisch., Hamburg, West Germany]

80-002108 Seethaler, K. LIFE HISTORY AND ECOLOGY OF THE COLORADO SQUAWFISH (*PTYCHOCHEILUS LUCIUS*) IN THE UPPER COLORADO RIVER BASIN. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:45-46. 30 Jan. 1980. Abstract only. SFA 25(3)
[Utah State Univ., Logan]

80-002109 Taphorn, D. C. and C. G. Lilyestrom. *PIABUCINA PLEUROTAENIA* REGAN, A SYNONYM OF *P. ERYTHRINOIDES* VALENCIENNES (PISCES: LEBIASINIDAE); ITS DISTRIBUTION, DIET AND HABITAT IN LAKE MARACAIBO BASIN, VENEZUELA. *Copeia* 1980(2):335-340. 1 May 1980. SFA 25(3)
[Univ. Nac. Exp. Llanos Occidentales Ezequiel Zamora (Unellez), Guanare, Portuguesa, Venezuela] Based on meristic, morphometric, coloration and

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002109 CONTINUED distributional data, arguments are presented to support placing *Piabucina pleurotaenia* in the synonomy of *P. erythrinoides* (the volador). The volador inhabits most of the clear upland streams of the Maracaibo Basin where it feeds primarily on insects, fish and some vegetable matter. Sexual dimorphism in body and fin size is pronounced, and males have a peculiar modification of the scales above the anal fin. The sensory pore system is well developed in this species. All Maracaibo Basin specimens have an adipose dorsal fin.

80-002110 Yoshida, H. O. SYNOPSIS OF BIOLOGICAL DATA ON BONITOS OF THE GENUS *SARDA*. *NOAA Tech. Rep. NMFS Circ.* 432. iv + 50p. May 1980. SFA 25(3)
[NMFS, Southwest Fish. Cent., Honolulu, HI 96812]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-002111 Allen, L. G. STRUCTURE AND PRODUCTIVITY OF THE LITTORAL FISH ASSEMBLAGE OF UPPER NEWPORT BAY, CALIFORNIA. *Ph.D. dissertation, Univ. South. Calif.* 1980. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5523. June 1980. SFA 25(3)

80-002112 Craig, J. F. GROWTH AND PRODUCTION OF THE 1955 TO 1972 COHORTS OF PERCH, *PERCA FLUVIATILIS* L., IN WINDERMERE. *J. Anim. Ecol.* 49(1):291-315. Feb. 1980. SFA 25(3)
[Freshwater Biol. Assoc., Ferry House, Far Sawrey, Ambleside, Cumbria, England] Mean lengths for age for cohorts of perch from 1955 to 1972 were calculated from directly measured fish and back-calculated lengths. Back-calculated lengths were corrected for allometry by using exponent values of 0.814 for immatures and males, and 0.723 for mature females. Back-calculated lengths were not usually significantly different from those measured directly. The von Bertalanffy growth model fitted the data well and values for the model are presented for male (1955 to 1972) and female (1955 to 1971) cohorts. L_∞ values for females were usually higher than the values for males. The general trend in growth since 1955 (and before that period) has been an increase in mean lengths with age and an increase in K and L_∞ values (statistics from the von Bertalanffy growth equation) for both sexes. There was a linear relationship between growth and mortality of cohorts. The correlation between K and Z (annual instantaneous mortality rate) was highly significant ($P < 0.001$) for cohorts from 1964 to 1972. Estimates are given of cohort production from age 2 until an age when the number in the population (N) < 1000. Prior to the 1964 cohort, losses due to reproductive products as a mean percentage of adult production was 20.8% for males and 87.4% for females but in later years was 11.1% for males and 36.0% for females. There were sharp differences in production, consumption and gross (or ecological) efficiency between slow and fast growing cohorts (1955 and 1968). Some approximations were made of the juvenile production, and its contribution to total production was much greater for fast growing cohorts (1968 male = 79%) than slow growing cohorts (1955 male = 59%). Annual production, gonad losses and biomass are given for the years 1961 to 1972. Total production ranged in the north basin from 11.1 $kJ/m^2/yr$ in 1966 to 47.9 $kJ/m^2/yr$ in 1972 and in the south basin from 23.0 $kJ/m^2/yr$ in 1966 to 158.2 kJ/m^2 in 1972. Cohort P/B ratios and annual P/B ratios were not found to be constant. Absolute fecundity (F) per unit length has increased over the period of investigation. For a 20 cm perch, $F_{1944/60} = 13,058 \pm 732$ and $F_{1975/76} = 47,580 \pm 5259$. Ecological life tables and age specific fecundity rates have been determined for female cohorts. Factors affecting the net

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

80-002112 CONTINUED reproduction rate are discussed and a model has been developed to predict these effects.

80-002113 Dadzie, S. RECENT CHANGES IN THE FISHERY OF A NEW TROPICAL MAN-MADE LAKE, LAKE KAMBURU (KENYA). *J. Fish Biol.* 16(4):361-367. Apr. 1980. SFA 25(3)
[FAO Reg. Aquacult. Cent. Africa, P.M.B. 6165, Port Harcourt, Nigeria] Five years after inundation, two varieties of *Cyprinus carpio*--the common carp and the mirror carp, have appeared in the commercial fishery in Lake Kamburu. Species of *Tilapia* continue to remain the most abundant fish in the lake and their numbers are on the increase. The second most numerous species is *Barbus* while *Labeo* sp. seems to be declining. The numbers of Mormyrus have declined drastically. Species of the genera *Tilapia, barbus* and *Cyprinus* are widely distributed within the lake; *Labeo* prefers the confluence of the rivers entering into the lake and *Normyrus* has moved upriver.

80-002114 Gilligan, M. R. BETA DIVERSITY OF A GULF OF CALIFORNIA ROCKY-SHORE FISH COMMUNITY. *Environ. Biol. Fishes* 5(2):109-116. 22 Apr. 1980. SFA 25(3)
[Dep. Ecol. Evol. Biol., Univ. Ariz., Tucson 85721] Reef fish community composition in three segments of a peninsular rocky shoreline in the Gulf of California was estimated over four periods by visual observation. 'Point' and 'bay' segments had regular and distinct species compositions over most periods while a 'middle' segment was least distinct but consistently had the greatest number of species. Compositional change along the peninsula was least regular during the coldest sea temperature period (April). Mean species turnover between segments was highest between point and bay. Within segments, the point had greater compositional predictable composition (lowest species turnover). When species with regular frequency of encounter were classified into 'point', 'middle', 'bay', and 'no trend' groups it was found that comparatively more 'point' species had pelagic eggs and comparatively more 'bay' species had demersal eggs. Beta diversity of rocky-shore fishes along the physical gradient of the Punta Doble peninsula reflects a transition between exposed and protected rocky shoreline communities. The correlated physical environmental characteristics associated with exposed and protected habitats are discussed in relation to diversity regulation and dispersal strategies in reef fishes.

80-002115 Kawasaki, T. FUNDAMENTAL RELATIONS AMONG THE SELECTIONS OF LIFE HISTORY IN THE MARINE TELEOSTS. *Bull. Jpn. Soc. Sci. Fish.* 46(3):289-293. Feb. 1980. SFA 25(3)
[Fac. Agric., Tohoku Univ., Sendai 980, Japan]

80-002116 Kovtun, I. F. SIGNIFICANCE OF THE SEX RATIO IN THE SPAWNING POPULATION OF THE ROUND GOBY, *NEOGOBIUS MELANOSTOMUS*, IN RELATION TO YEAR-CLASS STRENGTH IN THE SEA OF AZOV. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):161-163. 1979. SFA 25(3)
[AzNIIRKh, Rostov-on-Don, USSR]

80-002117 Leclerc, J. and G. Power. PRODUCTION OF BROOK CHARR AND OUANANICHE IN A LARGE RAPID, TRIBUTARY OF THE CANIAPISCAU RIVER, NORTHERN QUEBEC. *Environ. Biol. Fishes* 5(1):27-32. 30 Jan. 1980. SFA 25(3)
[Cent. Etud. Nord., Univ. Laval, PQ G1K 7P4, Canada] The age structure of brook charr (*Salvelinus fontinalis*) and ouananiche (*Salmo salar*) stocks inhabiting a large rapid in the river Méo, tributary

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

80-002117 CONTINUED to the Caniapiscau River were used to compare population stability and production of these species in north central Quebec. The brook charr stock was stable whereas ouananiche showed considerable variation in year class strength. Stock estimates were not significantly different for the two species although the brook charr estimate was 1.5 that of the ouananiche. Production estimates differed by a greater margin because of different growth patterns. Brook charr production was estimated at 19.4 kg/ha/yr. Above age 2+ it was 11.4 kg/ha/yr which compares with 4.8 kg/ha/yr for the same age groups of ouananiche.

80-002118 MacCall, A. D. POPULATION MODELS FOR THE NORTHERN ANCHOVY (*ENGRAULIS MORDAX*). *M.A. thesis, Calif. State Univ.* 84p. 1979. From Masters Abstr. 18(2):74. June 1980. SFA 25(3)

The growth of the northern anchovy (*Engraulis mordax*) central stock since 1951 can be described empirically by a logistic growth curve. The maximum average population growth rate is 353,000 short tons per year, and the asymptotic maximum average population size is 3.9 million short tons. The maximum sustainable average yield to a fishery is 484,000 short tons per year. A stochastic model of population growth is developed and is implemented as a Markov process with discrete biomasses as states. The abundance is highly variable in an unharvested state. Various management policies can be examined by the model, providing expected values, variances, and probabilities of various events or conditions.

80-002119 Serchuk, F. M.; C. J. Schmitt and B. Floyd. RAINBOW TROUT: A POPULATION SIMULATION BASED ON INDIVIDUAL RESPONSES TO VARYING ENVIRONMENTAL AND DEMOGRAPHIC PARAMETERS. *Environ. Biol. Fishes* 5(1):15-26. 30 Jan. 1980. SFA 25(3)

[Dep. Fish. Wildl., Mich. State Univ., East Lansing 48824]

80-002120 Van Woert, W. F. EXPLOITATION, NATURAL MORTALITY, AND SURVIVAL OF SMALLMOUTH BASS AND LARGEMOUTH BASS IN SHASTA LAKE, CALIFORNIA. *Calif. Fish. Game* 66(3):163-171. July 1980. SFA 25(3)

[Calif. Dep. Fish. Game, 627 Cypress Ave., Redding 96001] To obtain information on mortality and survival of black bass in Shasta Lake, $5 reward trailer tags were attached to smallmouth bass, *Micropterus dolomieui*, in 1973 and 1975 and to largemouth bass, *M. salmoides*, in 1975. First-year exploitation of 203 to 356 mm (8 to 14 in.) smallmouth bass tagged in 1973 was 0.68, natural mortality was 0.24, and survival was 0.08. First-year exploitation of 254- to 305-mm (10- to 12-in.) smallmouth bass tagged in 1975 was 0.70, natural mortality was 0.28, and survival was 0.02. First-year exploitation of 254- to 406-mm (10- to 16-in.) largemouth bass tagged in 1975 was 0.50, natural mortality 0.28, and survival 0.22. First-year exploitation of both species probably was lower than that indicated by tag returns since anglers were known to release some small bass after removing the tag. Survival of both species may have been underestimated since high turbidity levels in 1974 and the beginning of a 2-year drought in 1976 may have reduced angler use and/or success. High exploitation of smallmouth bass in Shasta Lake is the result of heavy angling pressure and high vulnerability of young smallmouth bass to natural baits. This high exploitation appears to be responsible for the large population of small smallmouth bass in Shasta Lake.

80-002121 Young, D. K. POPULATION DYNAMICS OF *CYPRINODON RADIOSUS*: A PRELIMINARY REPORT. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:51-53. 30 Jan. 1980. SFA 25(3)

[Calif. State Univ., Fresno]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

80-002122 Adams, J. C. and R. V. Kilambi. MATURATION AND FECUNDITY OF REDEAR SUNFISH. *Arkansas Acad. Sci. Proc.* 33:13-16. 1979. SFA 25(3)
[Okla. Water Resour. Bd., Fifth Floor, Jim Thorpe Bldg., Oklahoma City 73105] Based on gonosomatic indices and ovum diameter frequency distributions, the redear sunfish spawns from May through July. Fast growing 2-year-old (above 150 mm) and older fish attain sexual maturity. Mature ovum diameter ranged from 0.60 to 1.30 mm. Fecundity - total length, - total weight, and - age relationships were: lnF = 5.95242 + 0.01967L (r^2 = 0.90), lnF = 8.80328 + 0.00594W (r^2 = 0.92), and lnF = 8.19332 + 0.50231A (R^2 = 0.83), respectively.

80-002123 Andriyashev, A. P.; N. A. Butskaya and T. I. Faleeva. SEXUAL CYCLES OF ANTARCTIC FISHES *TREMATOMUS BERNACCHII* AND *PAGOTHENIA BORCHGREVINKI* (NOTOTHENIIDAE) IN CONNECTION WITH ADAPTATION. *Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR Ser. Biol.)* 249(1-6):1184-1187. Mar. 1980. SFA 25(3)
[Zool. Inst., Acad. Sci. USSR, Leningrad, USSR]

80-002124 Asahina, K.; K. Iwashita; I. Hanyu and T. Hibiya. [ANNUAL REPRODUCTIVE CYCLE OF A BITTERLING, *RHODEUS OCELLATUS OCELLATUS*. *Bull. Jpn. Soc. Sci. Fish.* 46(3):299-305. Feb. 1980. In Japanese with English summ. SFA 25(3)
[Fac. Agric. Vet. Med., Nihon Univ., Setagaya-ku, Tokyo 154, Japan]

80-002125 Bjerknes, V. and A. B. Vaag. MIGRATION AND CAPTURE OF PINK SALMON, *ONCORHYNCHUS GORBUSCHA* WALBAUM IN FINNMARK, NORTH NORWAY. *J. Fish Biol.* 16(3):291-297. Mar. 1980. SFA 25(3)
[Austevoll Stn. Mar. Aquacult., N-5490 Storebo, Norway] Pink salmon transplanted to the north Atlantic coast from the Soviet Union reached a peak in 1973, both in the Soviet Union and in Finnmark. Pink salmon catch statistics were compiled in 1977 for the inshore coastal and fjord areas of Finnmark from the atlantic salmon fisheries conducted locally and outside the coastal limits of Finnmark. The survey indicated a total sea catch of 12,800 specimens or 18,450 kg in Finnmark in 1977. The pink salmon reached the coast in the western regions of Finnmark during the first half of July, after which the main migration continued eastwards along the coast. The migrations into the western fjords were few, with half the total inshore catch captured in the most eastern fjord, Varangerfjord.

80-002126 Bradley, W. K., Jr. MOUTHBROODING AND COURTSHIP BEHAVIOR IN A NEOTROPICAL CICHLID, *GEOPHAGUS HONDAE*. *Fla. Sci.* 43(1):57-59. 1980. SFA 25(3)
[826 S. 13th St., Palatka, FL 32077]

80-002127 Fischer, E. A. THE RELATIONSHIP BETWEEN MATING SYSTEM AND SIMULTANEOUS HERMAPHRODITISM IN THE CORAL REEF FISH, *HYPOPLECTRUS NIGRICANS* (SERRANIDAE). *Anim. Behav. (Baillière Tindall, Publ.)* 28(2):620-633. May 1980. SFA 25(3)
[Popul. Dev. Biol. Group, Sch. Biol. Sci., Univ. Sussex, Falmer, Brighton, Sussex BN1 9QG, England] The behaviour and reproductive ecology of the simultaneously hermaphroditic coral reef fish, *Hypoplectrus nigricans* (Serranidae), the black hamlet, was investigated in an effort to elucidate the relationship between simultaneous hermaphroditism and mating behaviour. The major features of the mating system are as follows. (1) Hamlets spawn only in pairs, one partner releasing eggs and the other fertilizing them. There is no selfing. (2) Eggs are planktonic. There is no parental care.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002127 CONTINUED (3) The major courtship display serves to advertise that an individual has ripe eggs. (4) A clutch is not released in a single spawn but is parcelled over several, usually with the same partner. (5) Partners generally alternate sex roles with each spawn: that is, they take turns giving up parcels to be fertilized. This active reciprocation of release of eggs, called egg trading, means that reproductive success as a male depends upon the ability to reproduce as a female. Since most of the reproductive effort of an individual is spent on female functions, egg trading provides a fecundity advantage to hermaphroditism, making it evolutionarily stable relative to dioecy (separate sexes). The advantage is analogous to that which parthenogenetic organisms have over sexual ones. The fecundity advantage under egg trading can account for the maintenance, but not the origin of simultaneous hermaphroditism, since hermaphroditism must be established before egg trading can evolve.

80-002128 Fricke, H. W. CONTROL OF DIFFERENT MATING SYSTEMS IN A CORAL REEF FISH BY ONE ENVIRONMENTAL FACTOR. *Anim. Behav.* (*Baillière Tindall, Publ.*). 28(2):561-569. May 1980. SFA 25(3)

[Max-Planck-Inst., 8131 Seewiesen, West Germany] The Red Sea coral-dwelling damselfish *Dascyllus marginatus* is organized in stable territorial groups with males dominating all females. The fish live in pairs, harems or multi-male groups. Group size, and the number of sexually active males in a group, are correlated with coral size. Males monopolize and control the coral, attracting potential mates. The experimental alteration of coral sizes, using spherical *Stylophora* corals, resulted in an increase of male numbers, in artificially composed groups, with the increase of coral size. Thus pairs and harems were produced on small corals, multimale groups on big corals. Experiments with unisexual groups revealed a higher survival of females; males are more aggressive to each other, and cause a stronger emigration of subdominants. In *D. marginatus*, group size and the number of sexually active males are essentially restricted by one environmental factor; the number of available hiding places on a coral.

80-002129 Gromov, I. A. THE FECUNDITY OF THE EASTERN CARP, *CYPRINUS CARPIO HAEMATOPTERUS*. *J. Ichthyol.* (*Engl. Transl. Vopr. Ikhtiol.*) 19(1):98-103. 1979. SFA 25(3)

[Amur Dep., Pac. Res. Inst. Sea Fish. Oceanogr., Khabarovsk, USSR]

80-002130 Johnson, R. A. OXYGEN TRANSPORT IN SALMON SPAWNING GRAVELS. *Can. J. Fish. Aquatic Sci.* 37(2):155-162. Feb. 1980. In English with French summ. SFA 25(3)

[Inst. Water Resour., Univ. Alaska, Fairbanks 99701]

80-002131 Kedric-Brown, A. and B. Vestal. THE BREEDING SYSTEM OF THE BOTTOMLESS LAKES PUPFISH (*CYPRINODON PECOSENSIS*). *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:38. 30 Jan. 1980. Abstract only. SFA 25(3)

[Dep. Ecol. Evol. Biol., Univ. Ariz., Tucson] At high population density the breeding system of *Cyprinodon pecosensis* is one of male territoriality. Males established breeding territories on substrates with significant topographic complexity, such as rocky embankments, mats of submerged aquatic vegetation or single rocks scattered over a featureless silty bottom. Females preferred oviposition substrates which coincided with male preferences for territorial sites. Females preferred to oviposit on rocky substrates (93% of a total of 365 spawnings). Male reproductive success depended on territory quality and individual characteristics. Males with territories on rocky substrates had the highest spawning success (13 females mated per 30 min.). Occupants of territories situated primarily on silty substrate had lower spawning success (7 males mated per 30 min.).

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002131 CONTINUED There was a positive correlation between male reproductive success and the topographic complexity of the habitat ($r = 0.57$; $p < 0.005$; $N = 40$). Topographic complexity was defined as the ratio of the area occupied by prominent topographic features to total area of a territory. Both individual characteristics of males and the number of breeding males in an area enhance reproductive success. Males with fully developed breeding colorations had higher spawning rates (4 females mated per 30 min.) than pale males (0.5 females mated per 30 min.). Males defending territories in areas where there were several adjacent territories had a higher reproductive success (1.8 females mated per 30 min.) than solitary territorial males (0.9 females mated per 30 min.).

80-002132 Kennett, C. B. ASPECTS OF MATING BEHAVIOR AND SELECTION IN *POECILIOPSIS* POPULATION COMPLEXES (PISCES: POECILIIDAE). *Ph.D. dissertation, Fordham Univ.* 98p. 1980. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5509. June 1980. SFA 25(3)

80-002133 Kozlowski, L. J. BEHAVIORAL MECHANISMS OF REPRODUCTIVE ISOLATION IN *ETHEOSTOMA SPECTABILE* (AGASSIZ) AND *ETHEOSTOMA CAERULEUM* STORER. *Trans. Mo. Acad. Sci.* 13:198. 1979. Abstract only. SFA 25(3)

[Box 27, Williamsburg, MO 63388] This study was conducted to observe, describe, analyze, and compare the reproductive behavior of *Etheostoma spectabile* and *Etheosotma caeruleum* in order to determine what behavioral mechanisms help maintain reproductive isolation in these two species in South Central Missouri. The darters were observed both in the field in South Central Missouri and also in an artificial stream system. A fine behavioral difference was found in the courtship pattern between these two species. *E. spectabile* utilizes Head Wagging in the courtship sequence, and *E. caeruleum* does not. This, in addition to the slight differences in habitat and the time of spawning contributes to the maintenance of distinct species.

80-002134 Kuklin, A. A. MATURATION AND REPRODUCTION OF THE MUKSUN, *COREGONUS MUKSUN* OF THE YENISEY RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):91-97. 1979. SFA 25(3)

[Sibrybniiproyekt, USSR] The sexual maturation of the Yenisey muksun is of long duration; specimens of each year-class mature in the course of 10-15 years. The rate of sexual maturation of the muksun is determined mainly by the length of the juvenile stage and the period of protoplasmic growth. The duration of the latter is 5-6 years in fish maturing for the first time, and up to 1 year in fish which are rematuring. In most of the fish trophoplasmic growth begins in the year preceding spawning and lasts from 10 to 16 months. The complete cycle of repeat maturation and reproduction lasts no less than 2 years in the muksun and a greater interval between spawnings is possible. Individual muksun mature for the first time in the 10th-11th years of life, maturation occurs most commonly at an age of 13-15 years. The reproductive potential of the muksun population is determined both by the overall strength of the spawning population and by the ratio between recruitment and carryover.--concl.

80-002135 Laudien, H.; W. Fechner and W. Schumann. ZUR TEMPERATUREABHÄNGIGKEIT DER BALZ MÄNNLICHER GUPPYS, *POECILIA RETICULATA* PETERS (PISCES, CYPRINIDAE). [TEMPERATURE DEPENDENCY OF THE COURTSHIP OF MALE GUPPIES.] *J. Comp. Ethol.* 52(1):1-18. 1980. In German with English summ. SFA 25(3)

[Zool. Inst., Univ. Kiel, West Germany] In poikilothermal animals, modes

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002135 CONTINUED of behaviour as well as other physiological functions are dependent on the environmental temperature. Individual adaptation can decrease or cancel out this dependency. In experiments involving abrupt and slow temperature changes, we were able to prove temperature compensations and stress effects in the courting beahviour of the male *Poecilia reticulata*.

80-002136 Marsh, E. THE EFFECTS OF TEMPERATURE AND PHOTOPERIOD ON THE TERMINATION OF SPAWNING IN THE ORANGETHROAT DARTER (*ETHEOSTOMA SPECTABILE*) IN CENTRAL TEXAS. *Tex. J. Sci.* 32(2):129-142. June 1980. SFA 25(3)
[Dep. Zool., Coll. Nat. Sci., Univ. Tex., Austin 78712] In central Texas, *Etheostoma spectabile* ordinarily breeds from November to April. However, a population exposed to the continuously cold waters released from the hypolimnion of Canyon Lake (Comal County, Tx.) continued to breed well into the summer of 1976. This prolonged breeding season in a thermally altered environment suggested that a thermal cue is important in the termination of the spawning season of *E. spectabile* in central Texas. Breeding individuals of *E. spectabile* were exposed to 1 of the following 4 combinations of temperature and photoperiod: 24 C, 14 light (L):10 dark (D); 24 C, 10L:14D; 14 C, 14L:10D; 14 C, 10L:14D. Females exposed to warm treatments had significantly lower gonad weight (GW)/adjusted body weight (ABW) ratios than did females exposed to cold treatments. Females exposed to different photoperiods showed no significant differences in GW/ABW ratios. Males exposed to warm temperatures for 12 days had significantly lower GW/ABW ratios than did males exposed to cold treatments. Photoperiod had no significant effect on male GW/ABW ratios.

80-002137 Michael, J. H., Jr. REPEAT SPAWNING OF PACIFIC LAMPREY. *Calif. Fish Game* 66(3):186-187. July 1980. SFA 25(3)
[Star Rt. 2, Box 513, Port Townsend, WA 98368]

80-002138 Peters, C. E. and G. W. LaBar. FECUNDITY OF AN UNEXPLOITED POPULATION OF CISCOES IN THREE AREAS OF LAKE CHAMPLAIN. *N.Y. Fish Game J.* 27(1):72-78. Jan. 1980. SFA 25(3)
[Wildl. Biol. Prog., Univ. Vt., Burlington] Estimates of fecundity for ciscoes in three areas of Lake Champlain were based on examination of 108 specimens collected prior to spawning in 1976 and 1977. Absolute fecundity ranged from 6,932 to 24,868 eggs per female. Mean relative fecundity was 56.3 eggs per gram of body weight, which is higher than that reported for exploited populations in the Great Lakes. Based on logarithmic values, absolute fecundity increased linearly with length and weight, but not with age. Ciscoes in eutrophic Malletts Bay were fewer in number, smaller and less fecund, and had a lower condition factor, than those in the Main Lake and Northeast Arm which are mesotrophic to oligotrophic.

80-002139 Power, J. H. and J. D. McCleave. RIVERINE MOVEMENTS OF HATCHERY-REARED ATLANTIC SALMON (*SALMO SALAR*) UPON RETURN AS ADULTS. *Environ. Biol. Fishes* 5(1):3-13. 30 Jan. 1980. SFA 25(3)
[Migratory Fish Res. Inst., Univ. Me., Orono 04469] Hatchery-reared Atlantic salmon returning as adults to Maine's Penobscot River drainage basin were tagged with radio transmitters to permit long-term observation of their movements. Locations of salmon carrying small stomach-emplaced transmitters were periodically determined primarily from an airplane; canoes and road vehicles were also used. Objectives were to determine the patterns, routes and rates of salmon movement; to assess the effect of dams on the migration; and to compare the behavior of salmon that had been imprinted as smolts to headwaters with that of salmon released as smolts near the head of tide. No

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002139 CONTINUED consistent pattern of salmon movement emerged. Movement was erratic with wandering both up and downstream interspersed with position holding. A weak seasonal aspect to the movement was detected, with the minimum numbers moving in early September and the rates and distances of movement decreasing as the season progressed. Salmon often remained at various locations in the rivers for periods of time before subsequently moving. Salmon were also apparently impeded by dams, as on numerous occasions they were observed to approach a dam, then move back downstream. Some differences in behavior were found between the salmon imprinted as smolts to headwaters and those released as smolts at head of tide. Several imprinted salmon homed to a particular tributary when unimpeded by dams or homed by surmounting a dam, and several moved up to the base of the dam. Few unimprinted salmon moved up that tributary. The variable behavior and lack of strong upstream movement may be due to the salmon's lack of genome adapted to the Penobscot River drainage, the scarcity of conspecifics with their possible pheromonal influence, and the lack of a home stream and concomitant motivation to stimulate unimprinted salmon to progress upstream.

80-002140 Pressley, P. H. LUNAR PERIODICITY IN THE SPAWNING OF YELLOWTAIL DAMSELFISH, *MICROSPATHODON CHRYSURUS*. *Environ. Biol. Fishes* 5(2):155-159. 22 Apr. 1980. SFA 25(3)
[Dep. Zool., Univ. Calif., Berkeley 94720]

80-002141 Rinne, J. THE SPAWNING HABITAT AND BEHAVIOR OF *SALMO GILAE* MILLER, A RARE SOUTHWESTERN SALMONID. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:41. 30 Jan. 1980. Abstract only. SFA 25(3)
[Rocky Mtn. For. Range Exp. Stn., Tempe, AZ] The spawning season of *Salmo gilae* in three streams in the Gila National Forest, New Mexico commenced in early April and persisted through June, dependent upon stream elevation. Water temperature and streamflow interacted to induce spawning, however, the former was more important. Spawning commenced at water temperatures of ~8° C. Normally a single or a pair of fish occupied a redd, but three to four fish was not uncommon. Most spawning activity occurred between midday and late afternoon (1100-1600 hours). Fry emerged in 8 to 10 weeks at 15 to 20 mm in size and inhabited riffle areas. Avoidance of pools by fry indicated that cannibalism may occur. Redds were normally located about a quarter the distance of stream width from a bank in waters averaging from 6.0 to 15.0 cm in depth. Fine gravel (2 to 9 mm in size) comprised the greatest percentage (by weight) of substrate materials. Spawning fish selected redd sites more based on depth of water and substrate than they did on velocity. Normally, cover was less than 5 m from a redd site. Redds ranged in size from less than 0.1 m^2 to near 2.0 m^2. Redd depressions averaged 3 to 4 cm in depth.

80-002142 Yaron, Z.; M. Cocos and H. Salser. EFFECTS OF TEMPERATURE AND PHOTOPERIOD ON OVARIAN RECRUDESCENCE IN THE CYPRINID FISH *MIROGREX TERRAE-SANCTAE*. *J. Fish Biol.* 16(4):371-382. Apr. 1980. SFA 25(3)
[Dep. Zool., George A. Wise Fac. Life Sci., Tel-Aviv Univ., Tel-Aviv, Israel]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

80-002143 Boesman, E. L., Jr. and J. M. Dean. THE ABUNDANCE OF ESTUARINE LARVAL AND JUVENILE FISH IN A SOUTH CAROLINA INTERTIDAL CREEK. *Estuaries* 3(2):89-97. June 1980. SFA 25(3)

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

80-002143 CONTINUED
[Belle W. Baruch Inst. Mar. Biol. Coastal Res., Univ. S.C., Columbia 29208] The fall and winter population of larval fish in a small intertidal creek was measured. The creek was blocked at high tide, and the immature fish were captured in a channel net designed for consistent quantitative sampling as they left with the ebbing tide. A total of 573,739 individuals with a biomass (preserved wet weight) of 66.1 kg were captured during the eight month sampling period (October 1974-May 1975). Twelve families, 13 genera, and 16 species were represented, with five species comprising 99.3% of the fish captured. The five species were: *Leiostomus xanthurus* (53.5%), *Lagodon rhomboides* (31.7%), *Brevoortia tyrannus* (11.9%), *Micropogon undulatus* (1.7%), and *Myrophis punctatus* (0.5%). The net was efficient, the catch was seasonal, and the greatest larval abundance occurred in February and March.

80-002144 Leclerc, J. and G. Power. LACK OF MOVEMENT OF BROOK CHARR AND OUANANICHE IN THE CANIAPISCAU RIVER, NORTHERN QUEBEC. *Environ. Biol. Fishes* 5(1):71-74. 30 Jan. 1980. SFA 25(3)
[Cent. Etud. Nord., Univ. Laval, PQ G1K 7P4, Canada] Marking experiments, 1974-76, showed that brook charr *Salvelinus fontinalis* and juvenile ouananiche *Salmo salar* moved very little during the summer or from year to year in the upper reaches of the Caniapiscau River, north central Quebec. The fish were concentrated in rapid sections of the river and there was little exchange between rapids.

80-002145 Leyzerovich, Kh. A. and M. N. Mel'nikova. THE SEAWARD MIGRATION OF DWARF MALES OF THE ATLANTIC SALMON, *SALMO SALAR*, AND THEIR RETURN TO THE RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):164-167. 1979. SFA 25(3)
[GosNIORKh, Leningrad, USSR]

80-002146 McBride, D. N. HOMING OF ARCTIC CHAR, *SALVELINUS ALPINUS* (LINNAEUS) TO FEEDING AND SPAWNING SITES IN THE WOOD RIVER LAKE SYSTEM, ALASKA. *Alaska Dep. Fish Game Inf. Leafl.* No. 184. iv + 23p. Mar. 1980. SFA 25(3)
[Alaska Dep. Fish Game, Div. Commer. Fish., Anchorage]

80-002147 Ogawa, Y. and T. Nakahara. MODE OF SPATIAL DISTRIBUTION OF PELAGIC FISH WITHIN THE COASTAL FISHING GROUND IN THE SOUTHWESTERN JAPAN SEA. *Jpn. J. Ecol.* 30(1):31-43. Mar. 1980. In English with Japanese summ. SFA 25(3)
[Yamaguchi Pref. Open-Sea Fish. Exp. Stn., Nagato 759-41, Japan] The present paper deals with patterns in spatial distributions of pelagic fish (*Engraulis japonica, Trachurus japonicus, Scomber japonicus, Etrumeus micropus* and *Sardinops melanosticta*) in coastal waters. It is based on the daily catch data obtained by eleven small purse seiners. It was found that commercial fishery could act as an efficient sampling method to study movements of fish group at a level of elemenatry population. Each species of the pelagic fish always constituted a separate and stable group, elementary population with a size of between 6 km and 11 km in an average diameter. Careful examinations of daily maps showing the distribution of each fish species suggested the presence of interrelationships between groups of pelagic fish.

80-002148 Quinn, N. J. ANALYSIS OF TEMPORAL CHANGES IN THE FISH ASSEMBLAGES IN SERPENTINE CREEK, QUEENSLAND. *Environ. Biol. Fishes* 5(2):117-133. 22 Apr. 1980. SFA 25(3)

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

80-002148 CONTINUED
[Dep. Fish. Technol., Univ. Technology, P.O. Box 793, Lae, Papua New Guinea]

80-002149 Shershnev, A. P. and A. I. Zhul'kov. FEATURES OF THE DOWNSTREAM MIGRATION OF YOUNG PINK SALMON AND SOME INDICES OF THE EFFICIENCY OF REPRODUCTION OF THE PINK SALMON; *ONCORHYNCHUS GORBUSCHA*, FROM PRITORNAYA RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):114-119. 1979. SFA 25(3)
[SakhTINRO, South Sakhalinsk, USSR]

80-002150 Siebert, D. J. MOVIMENTOS DE TRES PECES EN ARAVAIPA CREEK, ARIZONA. [MOVEMENTS OF THREE FISHES IN ARAVAIPA CREEK, ARIZONA.] *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:48. 30 Jan. 1980. In English and Spanish. Abstract only. SFA 25(3)
[Ariz. State Univ., Tempe]

80-002151 Southward, A. J. and B. McK. Bary. OBSERVATIONS ON THE VERTICAL DISTRIBUTION OF EGGS AND LARVAE OF MACKEREL AND OTHER TELEOSTS IN THE CELTIC SEA AND ON THE SAMPLING PERFORMANCE OF DIFFERENT NETS IN RELATION TO STOCK EVALUATION. *J. Mar. Biol. Assoc. U.K.* 60(2):295-311. May 1980. SFA 25(3)
[Mar. Biol. Assoc., Citadell Hill, Plymouth, England]

FOODS/FEEDING

80-002152 Armitage, T. M. and W. S. Alevizon. THE DIET OF THE FLORIDA POMPANO (*TRACHINOTUS CAROLINUS*) ALONG THE EAST COAST OF CENTRAL FLORIDA. *Fla. Sci.* 43(1):19-26. 1980. SFA 25(3)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, VA 23062] The diet of the Florida pompano (*Trachinotus carolinus*) was investigated by examing stomach contents of adults from the Indian River and juveniles from the surf zone off Brevard County. Juveniles consumed primarily benthic crustaceans, mainly *Emerita talpoida*, and the bivalve, *Donax variabilis*. The diet of the adults consisted mainly of bivalve molluscs in the families Tellinidae, Mactridae, and Arcidae. In comparison with juveniles, the adults displayed a decrease in the number of planktonic organisms that are selected as prey items. Availability of prey appears to be more important than caloric content of prey in determining the diet of *T. carolinus*. The diet of adult pompano may be more diverse in those individuals found near the inlet regions of the lagoon. Our findings differ from previous studies that have determined bivalves to be more important in the diet of juvenile Florida pompano and crustaceans to be dominant in the diet of adult Florida pompano.

80-002153 Bakanov, A. I. and L. N. Strizhnikova. ON THE RELATION BETWEEN CHANGES IN THE FOOD SUPPLY AND THE FEEDING OF THE EASTERN BREAM *ABRAMIS BRAMA ORIENTALIS*, IN THE VOLGA ARM OF RYBINSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):119-127. 1979. SFA 25(3)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Region, USSR] In the Volga arm of Rybinsk reservoir an increased biomass of benthos has been observed in recent years. As a result the food supply of the population of the Eastern bream, *Abramis brama orientalis*, has risen and the frequency of occurrence in the food of the bream of all the main groups of

FOODS/FEEDING (CONTINUED)

80-002153 CONTINUED invertebrates has increased considerably, but in spite of the sharp increase in stomach fullness and the improvement in the structure of the food supply, condition factors have barely changed. The increase in the biomass of the benthos has had a positive effect on the linear and weight growth of the bream.

80-002154 Brownell, C. L. WATER QUALITY REQUIREMENTS FOR FIRST-FEEDING IN MARINE FISH LARVAE. I. AMMONIA, NITRITE, AND NITRATE. *J. Exp. Mar. Biol. Ecol.* 44(2/3):269-283. 22 Apr. 1980. SFA 25(3)

[17281 S. Clackamas River Dr., Oregon City, OR 97045] The tolerance of marine fish larvae to ammonia, nitrite, and nitrate was investigated using the decrease in first-feeding incidence following a 24-h exposure as the criterion of response. Seven species, all hatched from pelagic eggs collected at sea, were used in these experiments; two soleids (*Heteromycteris capensis* Kaup, *Synaptura kleini* (Bonaparte)), a gadid (*Gaidropsarus capensis* (Kaup)), and four sparids (*Diplodus sargus* (L.), *Lithognathus mormyrus* (L.), *Pachymetopon blochi* (Val.), and an unidentified species). Concentrations that inhibited first-feeding are compared to 24-h LC_{50}'s for the same species, and to concentrations that are known to induce lethal and sublethal responses in other teleost species. Judging from its effect on first-feeding, un-ionized ammonia is considered to be a potential hazard in the rearing tank; nitrite and nitrate are non-toxic at levels likely to be encountered in practical marine fish culture. Data are presented on the age at first-feeding and point of no return for 10 species.

80-002155 Brownell, C. L. WATER QUALITY REQUIREMENTS FOR FIRST-FEEDING IN MARINE FISH LARVAE. II. pH, OXYGEN, AND CARBON DIOXIDE. *J. Exp. Mar. Biol. Ecol.* 44(2/3):285-298. 22 Apr. 1980. SFA 25(3)

[17281 S. Clackamas River Dr., Oregon City, OR 97045] Previously unfed larvae representing eight species of marine teleosts (a soleid, *Heteromycteris capensis* Kaup; a cynoglossid, *Trulla capensis* Kaup; a gadid, *Gaidropsarus capensis* (Kaup); a congiopodid, *Congiopodus spinifer* (Smith); three sparids, *Diplodus sargus* (L.), *Pachymetopon blochi* (Val.) and an undentified species; and a centracanthid, *Pterosmaris axillaris* (Boulenger)) were exposed for 24 h to various pH's and concentrations of dissolved oxygen and carbon dioxide and then tested for their ability to first-feed. Mortalities recorded during the 24-h exposure went into the fitting of response curves and the calculation of the LC_{50} and LC_{10}. The incidence of successful first-feeding during the subsequent 4-h exposure to food yielded values for the EC_{50} and EC_{10}. The exposure to sub-optimal conditions continued during the 4-h feeding test. The sensitivity of first-feeding larvae to high pH and dissolved oxygen may pose hazards for the marine fish culturists; low pH appears to be harmful (at least in the short term) only at levels below about pH 6.0; carbon dioxide poisoning is of doubtful importance in practical fish culture. There were only minor interspecific differences in calculated 24-h first-feeding EC_{50}'s, which suggests general applicability of the results to a wide variety of first-feeding marine fish larvae.

80-002156 Coates, D. PREY-SIZE INTAKE IN HUMBUG DAMSELFISH *DASCYLLUS ARUANUS* (PISCES, POMACENTRIDAE) LIVING WITHIN SOCIAL GROUPS. *J. Anim. Ecol.* 49(1):335-340. Feb. 1980. SFA 25(3)

[Dep. Zool., Univ. Gezira, P.O. Box 20, Wad Medani, Sudan] Field observations were made on the feeding behaviour of individuals amongst social groups of *D. aruanus*. The sizes of prey taken were investigated by the analysis of stomach contents. There was a clear relationship between the size of prey taken and the rank of an individual within its social group. On removal of the larger individuals from a social group, the smaller

FOODS/FEEDING (CONTINUED)

80-002156 CONTINUED individuals began to take prey previously destined for the former. These results are related to what is known from previous work about the movements of *D. aruanus* whilst feeding as a social group. It is concluded that the size of prey taken by *D. aruanus* is influenced by the social habit of this species. The relative position of an individual within its social group influences its subsequent prey intake.

80-002157 de Silva, S. S.; P. R. T. Cumaranatunga and C. D. de Silva. FOOD, FEEDING ECOLOGY AND MORPHOLOGICAL FEATURES ASSOCIATED WITH FEEDING OF FOUR CO-OCCURRING CYPRINIDS (PISCES: CYPRINIDAE). *Neth. J. Zool.* 30(1):54-73. Mar. 1980. SFA 25(3)
[Dep. Zool., Vidyalankara Campus, Univ. Sri Lanka, Sri Lanka]

80-002158 Ellison, J. P. DIETS OF MOUNTAIN WHITEFISH, *PROSOPIUM WILLIAMSONI* (GIRARD), AND BROOK TROUT, *SALVELINUS FONTINALIS* (MITCHILL), IN THE LITTLE WALKER RIVER, MONO COUNTY, CALIFORNIA. *Calif. Fish Game* 66(2):96-104. Apr. 1980. SFA 25(3)
[Calif. Dep. Fish Game, P.O. Box 47, Yountville 94599] Diets of brook trout, *Salvelinus fontinalis* (Mitchill), and mountain whitefish, *Prosopium williamsoni* (Girard), in July are described and compared to other studies. Diets were compared statistically and shown to be significantly different. Stomachs of brook trout contained insects of both terrestrial and aquatic origin, indicating a possible subsistence on the drift, whereas whitefish stomachs contained mostly immature aquatic insects, suggesting a bottom feeding habit. Differences between the diets of brook trout and whitefish are probably the result of differential feeding habits.

80-002159 Giles, N. A STOMACH SAMPLER FOR USE ON LIVE FISH. *J. Fish Biol.* 16(4):441-444. Apr. 1980. SFA 25(3)
[Sch. Life Sci., Dep. Biol. Soc., Univ. Coll. Buckingham, MK18 1EG, England] A stomach sampler for live fish is described and its construction outlined; 50 adult perch were sampled, subsequently killed and dissected to assess the efficiency of the device. Survival of previously sampled fish was followed using individually recognizable dorsal fin tags.

80-002160 Gilson, R. F. and A. Benson. PREY PREFERENCE AND SIZE-SELECTIVE PREDATION BY THE MOTTLED SCULPIN (*COTTUS BAIRDI BAIRDI* GIRARD). *Proc. Pa. Acad. Sci.* 53(2):135-138. 1979. SFA 25(3)
[622 Venango Ave., Cambridge Springs, PA 16403] Selective feeding habits of two mottled sculpin (*Cottus bairdi bairdi* Girard) size classes were examined in an experimental riffle of a West Virginia stream. Selection was determined by comparing sculpin stomach contents to prey abundance in the benthos. Each sculpin group selectively consumed specific prey items. Taxonomic diversification in prey consumption between sculpin size classes was demonstrated. In general, sculpins selectively consumed the largest individuals of a prey taxon.

80-002161 Gophen, M. FOOD SOURCES, FEEDING BEHAVIOUR AND GROWTH RATES OF *SAROTHERODON GALILAEUN* (LINNAEUS) FINGERLINGS. *Aquaculture* 20(2):101-115. June 1980. SFA 25(3)
[Kinneret Limnol. Lab., P.O. Box 345, Tiberias, Israel] Feeding habits and growth rates of the fingerlings of *Sarotherodon galilaeum* (Linnaeus) were studied experimentally. Seven types of food were given. Fingerlings fed on 'Forell pellets' (45% protein) had the highest growth rate compared with chlorophytes, mosquito larvae, 'Carp pellets' (35% protein), Lake zooplankton and fresh *Peridinium*. Gut analyses of

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80-002161 CONTINUED small fingerlings sampled in the lake during the winter (November-February) indicate that they collect food, mostly algae, from the bottom of shallow waters. Fingerlings fed experimentally on chlorophytes had the lowest growth rate. It is suggested that food conditions for small (< 5 g) fingerlings in Lake Kinneret during the winter months are suboptimal.

80-002162 Grossman, G. D.; R. Coffin; and P. B. Moyle. FEEDING ECOLOGY OF THE BAY GOBY (PISCES: GOBIIDAE). EFFECTS OF BEHAVIORAL, ONTOGENETIC, AND TEMPORAL VARIATION ON DIET. *J. Exp. Mar. Biol. Ecol.* 44(1):47-59. 8 Apr. 1980. SFA 25(3)

[Dep. Wildl. Fish. Biol., Univ. Calif., Davis 95616] The ontogenic, diel, seasonal, and yearly variations in gut fullness, diet, and prey diversity for a California estuarine gobiid (*Lepidogobius lepidus* Girard) were examined. Also the feeding behavior of this species was described. Small (<50 mm, SL) and large (J ≥ 50 mm, SL) gobies consumed similar prey types in different proportions. Major prey items were polychaetes, harpacticoid copepods, gammarid amphipods, molluscs, and other crustaceans. Diets of large and small gobies were not significantly correlated, and larger fish had a more diverse diet. Small fish fed at all times while larger gobies fed primarily at night. Changes in diet may be related to differential prey preferences, feeding chronologies, and increases in fish size. Both large and small gobies displayed seasonal differences in diet and prey diversity. Year-to-year changes in diet also were noted for both size classes. The bay goby uses different feeding behaviors to capture sedentary and motile prey and appears to forage opportunistically. This behavior is probably advantageous in an environment which fluctuates drastically.

80-002163 Hulberg, L. W. and P. Graber. DIET AND BEHAVIORAL ASPECTS OF THE WOLF-EEL, *ANARRHICHTHYS OCELLATUS*, ON SANDY BOTTOM IN MONTEREY BAY, CALIFORNIA. *Calif. Fish Game* 66(3):172-177. July 1980. SFA 25(3)

[Holmes & Harver, Inc., Antarctic Div., 999 Town & Country Rd., Orange, CA 92668] We studied the diet and behavior of wolf-eels occurring near artificial structures on a sandy bottom in Monterey Bay, California, to obtain information about their biology and natural history. Diet was determined by examining stomach contents. The principal prey items consumed were the slender crab, *Cancer gracilis*, and the sand dollar, *Dendraster excentricus*. Other species were of minor importance in their diet. Our data suggest that wolf-eels, in our study area, are noctural predators which forage over wide areas for food. Scuba divers observed wolf-eel behavior. The individuals observed displayed strong territorial, homing, and itinerant behaviors. Based on the numbers of individuals collected and observed at our stations, the wolf-eel population of Monterey Bay may be quite large.

80-002164 Janssen, J. and S. B. Brandt. FEEDING ECOLOGY AND VERTICAL MIGRATION OF ADULT ALEWIVES (*ALOSA PSEUDOHARENGUS*) IN LAKE MICHIGAN. *Can. J. Fish. Aquatic Sci.* 37(2):177-184. Feb. 1980. In English with French summ. SFA 25(3)

[Loyola Univ. Chicago, 6525 North Sheridan Rd., Chicago, IL 60626]

80-002165 Johnson, J. H. and N. H. Ringler. DIETS OF JUVENILE COHO SALMON (*ONCORHYNCHUS KISUTCH*) AND STEELHEAD TROUT (*SALMO GAIRDNERI*) RELATIVE TO PREY AVAILABILITY. *Can. J. Zool.* 58(4):553-558. Apr. 1980. In English with French summ. SFA 25(3)

[N.Y. State Dep. Environ. Conserv., Albany 12233] Monthly diets of juvenile coho salmon and steelhead trout and the composition of the bottom and drift

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80-002165 CONTINUED fauna were examined in a tributary of Lake Ontario. From June through September coho fed most heavily on terrestrial invertebrates, whereas steelhead fed primarily on benthic invertebrates. Diet overlap (C_λ) between coho and steelhead was not significant. The diet of coho was closely associated with the composition of the drift; the diet of steelhead was more closely associated with the bottom fauna. Food selection may be influenced by observed differences in distribution (riffle versus pool) of sympatric steelhead and coho salmon, but mode of feeding (surface versus bottom) may also play a role. Because of the close relationship between drift composition and diet in coho, we hypothesize that diel variation in diet will be greater in coho than in steelhead.

80-002166 Kokeš, J. THE FOOD EATEN BY THE FRY OF CHUB, LEUCISCUS CEPHALUS, IN THE ROKYTNÁ RIVER. *Folia Zool.* 28(4):361-370. 1979. In English with Russian summ. SFA 25(3)

[Inst. Vert. Zool., Czechoslovak Acad. Sci., Brno, Czechoslovakia] The food eaten by the chub fry in the Rokytná River consisted mainly of animal items. Of greatest importance were chironomid larvae which, during certain months, were supplemented or replaced by other items, above all, mayfly larvae and caddis worms. The chub fry subsisted mainly on aquatic organisms; terrestrial ones constituted only supplementary food; and the vegetable component was negligible. The variation in trophic diversity showed a marked maximum in August and September, and a marked minimum in January. Chub fry of all size groups consumed almost identical diets. However, there were differences in the index of fulness which attained considerably higher values in the smallest fish examined in June than in bigger fish during the remaining months.

80-002167 Lambert, Y. and G. J. Fitzgerald. SUMMER FOOD AND MOVEMENTS OF THE ATLANTIC TOMCOD *MICROGADUS TOMCOD* (WALBAUM) IN A SMALL TIDAL CREEK. *Nat. Can. (Que.)* 106(5-6):555-559. Sept.-Dec. 1979. In English with French summ. SFA 25(3)

[Dep. Biol., Univ. Laval, PQ G1K 7P4, Canada] Daily sampling of the fish community of a tidal creek, Rivière des Vases near Isle-Verte, Québec, indicated the presence of *Microgadus tomcod* from the end of May until the middle of July in 1978. Captured fish were grouped into four size classes: class I (85-120 mm) and class II (121-165 mm) made up the majority. Stomach content analysis of these two size classes showed that amphipod and chironomid larvae were the most important food items with amphipods being more important for class II than for class I fish. Polychaetes and crustacean larvae were more common in the diet of class III fish.

80-002168 Marais, J. F. K. ASPECTS OF FOOD INTAKE, FOOD SELECTION, AND ALIMENTARY CANAL MORPHOLOGY OF *MUGIL CEPHALUS* (LINNAEUS, 1958), *LIZA TRICUSPIDENS* (SMITH, 1935), *L. RICHARDSONI* (SMITH, 1846), AND *L. DUMERILI* (STEINDACHNER, 1869). *J. Exp. Mar. Biol. Ecol.* 44(2/3):193-209. 22 Apr. 1980. SFA 25(3)

[Univ. Port Elizabeth, P.O. Box 1600, Port Elizabeth 6000, South Africa] Feeding periodicity, selection efficiency and food consumption of *Liza dumerili* (Steindachner, 1869) and *L. richardsoni* (Smith, 1846) were determined. The effects of particle size and nature of ingested food on aspects of the morphology of the alimentary canal of *L. dumerili*, *L. richardsoni*, *Mugil cephalus* (Linnaeus, 1958) and *Liza tricuspidens* (Smith, 1935) are discussed. It was found that the dominant mullet species in the Swartkops estuary (South Africa) not only exhibit different feeding periodicities (*L. dumerili* and *L. richardsoni*) but that selected material in all the species differs in chemical as well as physical

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80-002168 CONTINUED properties. Alimentary canals of each species are morphologically well adapted for selection, ingestion and digestion of its preferred food items. These factors reduce interspecific competition among the different mullet species.

80-002169 Montgomery, W. L. and S. D. Gerking. MARINE MACROALGAE AS FOODS FOR FISHES: AN EVALUATION OF POTENTIAL FOOD QUALITY. *Environ. Biol. Fishes* 5(2):143-153. 22 Apr. 1980. SFA 25(3)

[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543] A revitalized view of feeding by herbivorous marine fishes is sought through two questions. First, what characteristics of major taxa of algae identify them as predictably high or low quality foods? Second, are marine algae valuable foods for fishes which do not mechanically disrupt cell walls and do not harbor specialized enzymes or microbes capable of lysing cell walls? Energy, ash and nutrient content of 16 species of marine algae were employed to assess food quality of fleshy red, green, brown and calcareous red algae. On the basis of ash, calories, total protein and total lipid content, fleshy algae should be superior to calcareous algae as foods for fishes; in addition, green algae should be superior to brown algae and brown algae superior to red algae. When the probable digestibility of storage and extracellular carbohydrates is considered, green and red algae are predicted superior to brown algae as food. Two species of damselfishes (Pomacentride) from the Gulf of California, *Eupomacentrus rectifraenum* and *Microspathodon dorsalis*, eat red and green algae and ignore brown and calcareous algae. They feed, therefore, in a fashion consistent with predictions based only on algal chemistry. These fishes absorb at least 20-24% of the biomass, 57-67% of the protein, 46-56% of the lipid and 37-44% of the carbohydrate contained in algae eaten in the wild. Since these damselfishes do not masticate their food, it appears that herbivorous fishes can digest major fractions of algal nutrients without mechanical destruction of algal cells.

80-002170 Ney, J. J.; E. D. Ricci and W. R. Reynolds. TROPHIC RELATIONS AMONG YOUNG-OF-YEAR SPORT FISH SPECIES IN THE LITTORAL ZONE OF VIRGINIA RESERVOIRS. *Va. J. Sci.* 30(2):77. 1979. Abstract only. SFA 25(3)

[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] Food habits of coexisting young-of-year fishes were examined from summer cove rotenone catches in Claytor and Smith Mountain Lakes. In the former, diets of three endemic species, largemouth bass, crappie and smallmouth bass, were compared to the food habits of the exotic, white bass. Diets of the three native species demonstrated partial resource partitioning, but white bass food habits were congruent with crappie, indicating possible trophic competition. In Smith Mt. Lake, diets of native largemouth bass and stocked striped bass were analyzed. Food habits by major category did not differ significantly between the species, although striped bass fed more heavily on fish while largemouth bass utilized a high proportion of neustonic insects. In both situations, dietary overlap between young-of-year native and exotic sport species indicates the possibility of trophic competition which may affect growth and survival. Predictions of impact of exotic introductions should include detailed analysis of this overlooked aspect of interspecific relations.

80-002171 Schreiber, D. C. RELACIONES DE ALIMENTACION DE PECES EN ARAVAIPA CREEK, ARIZONA. [FEEDING INTERRELATIONSHIPS OF FISHES OF ARAVAIPA CREEK, ARIZONA.] *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:44. 30 Jan. 1980. In Spanish and English. Abstract only. SFA 25(3)

[Univ. Okla., Norman] Food habits of seven native species of fishes were examined over a 13-month period in Aravaipa Creek, Graham County, Arizona. Availability of foods to the fishes was estimated by sampling benthic communities and stream drift. Three trophic patterns were presented: herbivory by a mountain-sucker (*Pantosteus clarki*); omnivory by longfin

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80-002171 CONTINUED dace (*Agosia chrysogaster*); and carnivory by the remaining five species (*Gila robusta, Meda fulgida, Rhinichthys osculus, Tiaroga cobitis,* and *Catostomus insignis*). Ephemeropteran nymphs were the predominant food of the carnivorous fishes, and of the omnivore, and were the dominant invertebrate in both benthos and drift. When absolute densities and average individual body sizes of mayfly nymphs decreased dramatically, three fish species each shifted to a different alternate prey, and three others did not obviously respond. (One species, *G. robusta*, was not studied quantitatively.) Fishes which responded to alternate prey increased special feeding behavior and spatial partitioning of habitat. Those which did not respond remained as generalized feeders. Interspecific interactions related to feeding habits are probably minimal in Aravaipa Creek because of the abundance of food organisms and spatial segregation of the fishes.

80-002172 Targett, T. E. TROPHIC ECOLOGY AND STRUCTURE OF COASTAL ANTARCTIC FISH COMMUNITIES. *Ph.D. dissertation, Univ. Me.* 86p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5527. June 1980. SFA 25(3)

80-002173 Ware, R. R. THE FOOD HABITS OF THE WHITE CROAKER *GENYONEMUS LINEATUS* AND AN INFAUNAL ANALYSIS NEAR AREAS OF WASTE DISCHARGE IN OUTER LOS ANGELES HARBOR. *M.A. thesis, Calif. State Univ.* 175p. 1979. From Masters Abstr. 18(2):84. June 1980. SFA 25(3)

Studies of the benthic infauna and the food habits of the white croaker *Genyonemus lineatus* (Ayres) (Pisces: Sciaenidae) in Outer Los Angeles Harbor were conducted between January 1976 and January 1977. The benthos was impoverished near the tuna cannery outfalls, but abundances and species counts increased within a short distance. Classification analysis clustered the infaunal stations into three site groups and species into five assemblages. *Genyonemus* displayed omnivorous food habits and fed on 132 invertebrate taxa which included planktonic, epibenthic, and infaunal species. The food habits of *Genyonemus* were influenced by the fish's size, proximity to the waste discharges, and seasonal fluctuations of prey numbers. Feeding selectivity on benthic species was related to the diversity of the infaunal community. Amorphous fish cannery effluent and fish muscle tissue, which presumably originated from the canneries, were consumed near the outfalls by approximately five percent of the total number of *Genyonemus* examined.

80-002174 Warner, D. J. STOMACH CONTENT ANALYSIS OF BROOK TROUT AND RAINBOW TROUT. *Blue Jay* 38(1):15-16. Mar. 1980. SFA 25(3)

[For. Technol. Sch., Hinton, AB, Canada]

80-002175 Weihs, D. HYDRODYNAMICS OF SUCTION FEEDING OF FISH IN MOTION. *J. Fish Biol.* 16(4):425-433. Apr. 1980. SFA 25(3)

[Dep. Aeronaut. Eng., Technion-Israel Inst. Technol., Haifa, Israel] Forward motion was shown to increase the efficiency of suction feeding by causing the ingested volume to be predominantly in front of the fish, instead of being a sphere centered on the fish mouth. This increases the distance from which a prey, located in front of the predator, can be ingested by suction. A general hydrodynamic model of the external effects of the suction process is presented, showing that this is dependent upon a single non-dimensional parameter, the ratio of a characteristic mouth dimension, divded by the forward swimming speed and the suction time. Data for large-mouth bass, *Micropterus salmoides* show that the observed average forward velocity while feeding, of 3.1 body length/s, serves to increase the ingestion range by more than 60% over suction while not moving.

FOODS/FEEDING (CONTINUED)

80-002176 Zur, O. and S. Sarig. OBSERVATIONS ON THE FEEDING OF COMMON CARP (*CYPRINUS CARPIO*) ON CHIRONOMID LARVAE. *Bamidgeh* 32(1):25-26. Mar. 1980. SFA 25(3)
[Minist. Agric., Fish. Dep., Genosar, P.O.B. 33, Tiberias, Israel] The Common Carp (*Cyprinus carpio* L.) is a well known predator on midge larvae (Chironomidae) both under natural conditions and when grown in fish ponds. In this work, 30 young carp (95-105mm length) were individually fed midge larvae under aquarium conditions. The resulting high rate of larval consumption (up to 65 larvae consumed per fish within 4 hours) was in direct contrast to previously published data.

AGE AND GROWTH

80-002177 Ashley, K. W. and D. L. Garling, Jr. IMPROVED METHOD FOR PREPARING PECTORAL SPINE SECTIONS OF CHANNEL CATFISH FOR AGE DETERMINATIONS. *Prog. Fish-Cult.* 42(2):80-81. Apr. 1980. SFA 25(3)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061]

80-002178 Beaulieu, M.-A.; S. U. Qadri and J. M. Hanson. AGE, GROWTH, AND FOOD HABITS OF THE PUMPKINSEED SUNFISH, *LEPOMIS GIBBOSUS* (LINNAEUS), IN LAC VERT, QUÉBEC. *Nat. Can. (Que.)* 106(5-6):547-553. Sept.-Dec. 1979. In English with French summ. SFA 25(3)
[Dep. Biol., Univ. Ottawa, Ottawa, ON K1N 6N5, Canada] The pumpkinseed, *Lepomis gibbosus* (Linnaeus), was the dominant fish species of the littoral zone of Lac Vert, Québec. The length-weight relationship was: log WT = 3.195 log FL - 5.008. Fulton's coefficient of condition averaged 2.35 (FL) for ages 0+ to 7+. Back calculations of fork length were determined and the ultimate length (L_∞) for Lac Vert pumpkinseed was derived from the Walford graph as 179.4 mm. There were 3 males caught for every 2 females. Maturity was attained at age 3+. The annual mortality rate was 81% between ages 4+ and 7+. The diet consisted mainly of dipterans, cladocerans, ostracods, and decapods.

80-002179 Biette, R. M. and G. H. Geen. GROWTH OF UNDERYEARLING SOCKEYE SALMON (*ONCORHYNCHUS NERKA*) UNDER CONSTANT AND CYCLIC TEMPERATURES IN RELATION TO LIVE ZOOPLANKTON RATION SIZE. *Can. J. Fish. Aquatic Sci.* 37(2):203-210. Feb. 1980. In English with French summ. SFA 25(3)
[Fish. Br., Ontario Minist. Nat. Resour., Queen's Park, Toronto, ON M7A 1W3, Canada]

80-002180 Brady, D. R. AGE DETERMINATION UTILIZING CALCIFIED ANNULI IN THE DENTARY BONE OF THE PADDLEFISH (*POLYODON SPATHULA*). *Proc. Nebr. Acad. Sci. Affl. Soc.* 90:5. 1980. Abstract only. SFA 25(3)
[Dep. Biol., Univ. Nebr., Omaha 68182] Age determination of Paddlefish (*Polyodon spathula*) is accomplished by counting growth rings (annuli) in the dentary bone. Prior techniques employed unstained preparations which made evaluation difficult. In this study the cartilagenous nature and presence of calcification in the Paddlefish was utilized histochemically for age determination. A modified LaMarca technique, employing the calcium specific properties of Alizarin Red S, was applied to 23 jaw samples covering 12 age classes. Samples were taken from the dentary bone angle using a 'Dremel' saw. The thin sections were then placed in a solution composed of saturated Alizarin Red S and 0.2% sodium hydroxide (1:9) for six hours, rinsed in distilled water, differentiated in 3% hydrogen peroxide for three to six hours and stored in 70% ethanol. Results show clear to light pink regions between dark red annuli.

AGE AND GROWTH (CONTINUED)

80-002181 Frost, W. E. and C. Kipling. THE GROWTH OF CHARR, *SALVELINUS WILLUGHBII* GÜNTHER, IN WINDERMERE. *J. Fish Biol.* 15(3):279-289. Mar. 1980. SFA 25(3)

[C. Kipling: Freshwater Biol. Assoc., Ambleside, Cumbria, England] The growth of charr (*Salvelinus willughbii* Günther) caught in Windermere from 1941-1952 has been studied. Sclaes were used for determination of age and back-calculation of length for age. Autumn and spring spawners, males and females, and charr of normal and dwarf growth were treated separately. In fish of normal growth, the spring spawners were significantly smaller than the autumn spawners at ages 1 and 2 years, and significantly larger from age 4 years onwards. There was little difference in growth between males and females within the two spawning populations. Charr of lengths of less than 200 mm at age 4 years were considered to be dwarfs. Mean lengths at capture of male charr were: autumn spawners normal growth 272 mm, dwarf 218 mm; spring spawners normal growth 327 mm, dwarf 194 mm. The oldest recorded age was 8 years.

80-002182 Kakuda, S. and K. Nakai. ON THE AGE AND GROWTH OF *NIBEA ALBIFLORA*. *Bull. Jpn. Soc. Sci. Fish.* 46(2):139-143. Feb. 1980. SFA 25(3)

[Fac. Appl. Biol. Sci., Hiroshima Univ., Fukuyama 720, Japan] In order to clarify the age and growth of *Nibea albiflora* in the Seto Inland Sea, samples were collected during one year from the landings picked up from the Sea. Each scale removed from the sample specimen was examined and measured. The results of analysis of the annual ring on the scales show that one annulus is formed once a year, in the month of June and July. As the spawning season runs from May to August and since most specimens of fish spawn in June and July, the time of the formation of the new annulus is approximately in accordance with the spawning season. The standard length of this species found in the Seto Inland Sea is 151, 238, 305 and 357 mm on an average at the ages of full 1, 2, 3 and 4 years, respectively. The general growth formula for this species is adequately expressed by the following equation ascribed to Bertalanffy: $L_t=529(1-e^{-0.261t-0.0736})$. The growth of the yearling immature fish was studied on samples collected in August, September and November. This growth, on the basis of an analysis of the progression of mean and mode in succesive length-frequency distributions of the immature fishes, was discussed as compared with the growth estimated from the monthly changes of the marginal growth index of the scale.

80-002183 Kohlhorst, D. W.; L. W. Miller and J. J. Orsi. AGE AND GROWTH OF WHITE STURGEON COLLECTED IN THE SACRAMENTO-SAN JOAQUIN ESTUARY, CALIFORNIA: 1965-1970 AND 1973-1976. *Calif. Fish Game* 66(2):83-95. Apr. 1980. SFA 25(3)

[Bay-Delta Fish. Proj., Calif. Dep. Fish Game, 4001 N. Wilson Way, Stockton 95205] AGES OF WHITE STURGEON, *Acipenser transmontanus*, collected in the Sacramento-San Joaquin Estuary from 1965 to 1970 and from 1973 to 1976 were estimated from transverse sections of pectoral fin rays. Sturgeon were difficult to age and there was considerable disagreement between individuals interpreting ages. Estimates of male and female growth rates were not significantly different. A von Bertalanffy growth curve was calculated for ages 0-21 from the 1973-1976 collection. A length-weight relationship was estimated from 1965-1970 data. Estimated growth rate was similar in 1965-1970 and 1973-1976, but was lower than in 1954. It was not possible to determine if a recent decrease in growth rate was real or was due to different aging techniques. Possible causes of reduced growth are discussed.

80-002184 Misra, R. K. STATISTICAL COMPARISONS OF SEVERAL GROWTH CURVES OF THE VON BERTALANFFY TYPE. *Can. J. Fish. Aquatic Sci.* 37(6):920-926. June 1980. In English with French summ. SFA 25(3)

[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

AGE AND GROWTH (CONTINUED)

80-002185 Refstie, T. GENETIC AND ENVIRONMENTAL SOURCES OF VARIATION IN BODY WEIGHT AND LENGTH OF RAINBOW TROUT FINGERLINGS. *Aquaculture* 19(4):351-357. Apr. 1980. SFA 25(3)

[Dep. Anim. Genet. Breeding, Agric. Univ. Norway, 1432 Ås-NLH, Norway] Environmental and genetic factors influencing the growth rate of rainbow trout were studied. Body weight and length at a standard age were significantly affected by first-feeding date and number of fish held in a tank. The estimates of heritabilites found for different year-classes varied. The heritabilities estimated from the total data after adjustment for first-feeding date and density were 0.06 for weight and 0.20 for length using the sire components of variance. Calculated from the dam components, the heritabilities were 1.04 for weight and 0.43 for length. The genetic and phenotypic correlations between length and weight estimated from the total data were 1.02 and 0.93, respectively.

80-002186 Ricker, W. E. CHANGES IN THE AGE AND SIZE OF CHUM SALMON (*ONCORHYNCHUS KETA*). *Can. Dep. Fish. Oceans Tech. Rep.* No. 930. vii + 99p. Apr. 1980. In English with French summ. SFA 25(3)

[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Both in British Columbia and in Alaska, size of chums at a given age has decreased since 1951 along with a general decrease in ocean temperatures. To determine whether this is an accidental or a meaningful coincidence, the residuals of temperature and size from their respective linear regressions on time were computed and compared, during 1951-1975. Weight residuals were positively but weakly correlated with temperature residuals in the last year (approximately) of life, and negatively correlated with the temperature 1 or 2 years earlier. However, all such correlations were small; the corresponding regressions were only 1/3 to 1/10 of the change in weight actually oabserved, and were sometimes of the wrong sign. In addition, chums were small during the late 1940s when temperatures were high. Thus it is still problematical whether ocean temperature changes, within the range observed, have had any significant effect on the size of chum salmon in British Columbia.--From abstr.

80-002187 Rossi, R. and P. Villani. A BIOLOGICAL ANALYSIS OF EEL CATCHES, *ANGUILLA ANGUILLA* L., FROM THE LAGOONS OF LESINA AND VARANO, ITALY. *J. Fish Biol.* 16(4):413-423. Apr. 1980. SFA 25(3)

[Inst. Zool., Univ. Ferrara, Italy] A study of eel catches from Lesina (444 specimens) and Varano lagoons (324 specimens), in southern Adriatic, Italy, was made. Male silver eels in Lesina ranged from 33.4-51.5 cm in length, with a mean of 42.6 cm; from 50-240 g in weight, with a mean of 141 g and were 1.5-6.5 years old with a mean of 2.5 years. The average length of male silver eels in Varano lagoon was 40.5 cm (range 31-48.5 cm); the average weight was 122 g (range 80-220 g) and a mean age of 2.6 years (range 1.5-7.5 years). The females are bigger, heavier and older than the males with, in Lesina, a mean length of 61 cm (range 50.9-74.3 cm), a mean weight of 438 g (range 240-730 g) and a mean age of 3.4 years (range 1.5-6.5). The average length of Varano female silver eels was 58 cm (range 50.8-72.5 cm), and the average weight was 383 g (range 225-840 g). They were 1.5-7.5 years old, with an average of 3.8 years. Female silver eels were only 20% of the population at Lesina and 10% at Varano. In comparison with the silver eel populations of the North Adriatic lagoons, the North Sea or the Atlantic Ocean , the silver eels of Lesina and Varano show a greater growth rate, are younger and have a sex ratio in favour of the males. The water temperature, higher than in other countries, could be an important factor affecting the differences in age and growth rates between Lesina and Varano silver eels and those of other waters.

80-002188 Sainsbury, K. J. EFFECT OF INDIVIDUAL VARIABILITY ON THE VON BERTALANFFY GROWTH EQUATION. *Can. J. Fish. Aquatic Sci.* 37(2):241-247. Feb. 1980. In English with French summ. SFA 25(3)

[Div. Fish. Oceanogr., CSIRO, P.O. Box 21, Cronulla 2230, Australia]

AGE AND GROWTH (CONTINUED)

80-002189 Schmidt, R. E. and M. C. Fabrizio. DAILY GROWTH RINGS ON OTOLITHS FOR AGING YOUNG-OF-THE-YEAR LARGEMOUTH BASS FROM A WILD POPULATION. *Prog. Fish-Cult.* 42(2):78-80. Apr. 1980. SFA 25(3)
[Colder Conserv. Ecol. Stud. Cent., Fordham Univ., 31 Whipporwill Rd., Armonk, NY 10504]

80-002190 Shelbourn, J. E. EARLY GROWTH RATES OF CHUM SALMON FRY (*ONCORHYNCHUS KETA*) IN THE LABORATORY IN FRESH AND SALT WATER. *Can. Dep. Fish. Oceans Tech. Rep.* No. 937. iii + 6p. Apr. 1980. In English with French summ. SFA 25(3)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Specific growth rates were obtained for chum fry (*Oncorhynchus keta*) acclimated to three temperatures and fed excess ration over a 28-day period, starting at an initial weight of 0.35 g. The rates were 1.8 (5°C), 4.4 (10°C), 5.9 (15°C), and 5.9 (15°C, 28°/oo s.w.) % wet weight/day. The growth rates are compared with those obtained for other salmonid species, with a consideration of the diet of wild chum fry.

80-002191 Shireman, J. V.; D. E. Colle and M. J. Maceina. GRASS CARP GROWTH RATES IN LAKE WALES, FLORIDA. *Aquaculture* 19(4):379-382. Apr. 1980. SFA 25(3)
[Aquatic Weed Res. Cent., Univ. Fla., Gainesville] Grass carp (*Ctenopharyngodon idella*) were collected from Lake Wales, Florida, a hydrilla (*Hydrilla verticillata*) infested lake, for a 4-year period. Average daily growth per year ranged from 10.0 to 10.4 g/day. Grass carp averaged 962 mm total length and 15.0 kg after 48 months.

80-002192 Wolfert, D. R. AGE AND GROWTH OF ROCK BASS IN EASTERN LAKE ONTARIO. *N.Y. Fish Game J.* 27(1):88-90. Jan. 1980. SFA 25(3)
[Scheid Rd., RD Box 381E, Huron, OH 44839]

80-002193 Worthmann, H. THE EARLY GROWTH STAGES OF THE PESCADA (*PLAGIOSCION MONTI* SOARES). *Arch. Fischereiwiss.* 30(2-3):145-156. Mar. 1980. In English with German and Portuguese summ. SFA 25(3)
[Inst. Nac. Pesq. Amazônia, Manaus, Brasil]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-002194 Alkahem, H. F. FRESHWATER FISHES OF SAUDI ARABIA. *Ph.D. dissertation, Colo. State Univ.* Nov. 1979. SFA 25(3)
[Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins 80523] This work is the first scientific collection and reports on freshwater fishes from large areas of Saudi Arabia. About 600 specimens representing 8 native known species, seven Cyprinids and one Cyprinodont were discussed. Three new *Cyprinion* were discovered. The first record of non-native fish (*Gambusia affinis*) from Saudi Arabia is given. Several new distributions are recorded. Comprehensive appraisal of geological, geographical, climatic history are correlated with zoogeographical evidence and interpretation of degree of divergence in present living species to provide interpretation of factors explaining present distribution and taxonomy of freshwater fishes of Arabia.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002195 Allendorf, F. W.; D. M. Espeland; D. T. Scow and S. Phelps. COEXISTENCE OF NATIVE AND INTRODUCED RAINBOW TROUT IN THE KOOTENAI RIVER DRAINAGE. *Proc. Mont. Acad. Sci.* 39:28-36. 1980. SFA 25(3)
[Dep. Zool., Univ. Mont., Missoula 59812] Rainbow trout (*Salmo gairdneri*) have been suspected to be native to some Montana drainages, although previous reports have indicated the contrary. We collected and electrophoretically examined 218 rainbow trout from six sampling locations in the Kootenai River drainage of northwestern Montana and Idaho with the goal of detecting any extant native populations. Large allelic differences exist among these samples collected within a small geographical area. Two of the population samples share close affinity to other inland rainbow trout populations and are very different from hatchery stocks of rainbow trout that have been planted in this area. One population sample was found to have intermediate frequencies, indicating an apparently random mating population containing both native and introduced trout. We conclude that populations of native and introduced rainbow trout, as well as their hybrids, presently exist in this drainage.

80-002196 Beecher, H. A. and B. H. Beecher. FIRST RECORD OF *COUESIUS PLUMBEUS* (AGASSIZ) (OSTEICHTHYES: CYPRINIDAE) FROM WASHINGTON. *Syesis* 12:175-176. 1979. SFA 25(3)
[1118 Skyridge St. SE, Olympia, WA 98503]

80-002197 Chaloner, W. G.; P. L. Forey; B. G. Gardiner; A. J. Hill and V. T. Young. DEVONIAN FISH AND PLANTS FROM THE BOKKEVELD SERIES OF SOUTH AFRICA. *Ann. S. Afr. Mus.* 81(3):127-157. Feb. 1980. SFA 25(3)
[Birbeck Coll., Univ. London, England]

80-002198 Coad, B. W. A PROVISIONAL, ANNOTATED CHECK-LIST OF THE FRESHWATER FISHES OF IRAN. *J. Bombay Nat. Hist. Soc.* 76(1):86-105. Apr. 1979. SFA 25(3)
[Ichthyol. Sect., Natl. Mus. Nat. Sci., Ottawa, ON K1A 0M8, Canada]

80-002199 Crossman, E. J. and H. D. Van Meter. ANNOTATED LIST OF THE FISHES OF THE LAKE ONTARIO WATERSHED. *Great Lakes Fish. Comm. Tech. Rep.* No. 36. 25p. June 1979. SFA 25(3)
[Dep. Ichthyol. Herpetol., Royal Ontario Mus., Toronto, ON M5S 2C6, Canada] This annotated list of the fishes of Lake Ontario and its watershed is based on published distribution records, museum collections, and reports of fish surveys that confirm the occurrence of fish species dating back to the 1850's. It includes 130 forms (129 spp. + the hybrid splake), 20 of which have disappeared or are extremely rare today. Considering species present only in the lake proper, 64 were reported in 1929, and 51 of those remained in 1972-73 (13 having disappeared). Seventeen species and the splake are fishes not known to have occurred in the lake in 1929 or were introduced since then. A list of 86 references pertinent to the study of the fish fauna of the watershed is given. The present list, started in 1972, includes some information from as late as 1976.

80-002200 D'Croz, L. and A. A. Averza. OBSERVACIONES SOBRE LA ABUNDANCIA Y DIVERSIDAD DE LAS POBLACIONES DE PECES ESTUARINOS EN EL CARIBE DE PANAMÁ. [OBSERVATIONS ON THE ABUNDANCE AND DIVERSITY OF ESTUARINE FISH POPULATIONS OF THE CARIBBEAN COAST OF PANAMA.] *Rev. Biol. Trop.* 27(2):189-201. 1979. In Spanish with English summ. SFA 25(3)
[Lab. Biol. Mar., Escuela Biol., Univ. Panama, Panama]

80-002201 Deacon, J. E. ENDANGERED AND THREATENED FISHES OF THE WEST. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:34. 30 Jan. 1980. Abstract only. SFA 25(3)
[Univ. Las Vegas, Las Vegas, NV]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002201 CONTINUED

80-002202 Dexter, R. W. THE KIRTLAND-STORER CORRESPONDENCE ON OHIO FISHES (1838-45) AND A KIRTLAND-BAIRD COLLECTION OF OHIO FISHES (1853). *Kirtlandia* No. 32. p. 1-19. 16 June 1980. SFA 25(3)
[Dep. Biol. Sci., Kent State Univ., Kent., OH 44242] Excerpts from 22 letters that Dr. Jared Potter Kirtland sent to Dr. David Humphreys Storer (1838-45) have been selected to illustrate the problems Kirtland faced in developing studies on the fishes of Ohio, and his growth from a beginner to the leading authority on the fish fauna of Ohio. Also, a list of 45 species of fishes collected by Dr. Kirtland and Spencer Fullerton Baird in August of 1853 from Yellow Creek and the Mahoning River is given with a list of 16 species reported to them from the area, but not collected by them. Current names as recognized by Trautman (1957) are added.

80-002203 Elser, A. A.; M. W. Gorges and L. M. Morris. DISTRIBUTION OF FISHES IN SOUTHEASTERN MONTANA. *Mont. Dep. Fish Wildl. Parks* v + 132p. Apr. 1980. Available from Mont. Dep. Fish Game, Box 430, Miles City 59301. SFA 25(3)

80-002204 Fitch, J. E. THE BIGSCALE GOATFISH, *PSEUDUPENEUS GRANDISQUAMIS* (GILL, 1863), ADDED TO CALIFORNIA'S MARINE FAUNA. *Calif. Fish Game* 66(2):123-124. Apr. 1980. SFA 25(3)
[2657 Averill Ave., San Pedro, CA 90731]

80-002205 Flescher, D. B. GUIDE TO SOME TRAWL-CAUGHT MARINE FISHES FROM MAINE TO CAPE HATTERAS, NORTH CAROLINA. *NOAA Tech. Rep. NMFS Circ.* 431. iii + 34p. Mar. 1980. SFA 25(3)
[NMFS, Woods Hole, MA 02543]

80-002206 Fusaro, C. and S. Anderson. FIRST CALIFORNIA RECORD: THE SCALLOPED HAMMERHEAD SHARK, *SPHYRNA LEWINI*, IN COASTAL SANTA BARBARA WATERS. *Calif. Fish Game* 66(2):121-123. Apr. 1980. SFA 25(3)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

80-002207 Goren, M. ON THE OCCURRENCE OF *ACENTROGOBIUS BELISSIMUS* (PISCES: GOBIIDAE) IN THE RED SEA. *Isr. J. Zool.* 28(2/3):160-162. 1979. SFA 25(3)
[Dep. Zool., Tel Aviv Univ., Tel Aviv, Israel]

80-002208 Hendrickson, D. UN ESTUDIO DEL ICTIOFAUNA DEL RIO YAQUI. [A SURVEY OF THE RIO YAQUI ICHTHYOFAUNA.] *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:36. 30 Jan. 1980. In English and Spanish. Abstract only. SFA 25(3)
[Aris. State Univ., Tempe]

80-002209 Hergenrader, G. L. CURRENT DISTRIBUTION AND POTENTIAL FOR DISPERSAL OF WHITE PERCH (*MORONE AMERICANA*) IN NEBRASKA AND ADJACENT WATERS. *Am. Midl. Nat.* 103(2):404-406. Apr. 1980. SFA 25(3)
[Sch. Life Sci., Univ. Nebr., Lincoln 68588] The white perch (*Morone americana*) was accidentally introduced into a flood control reservoir in eastern Nebraska where it developed a large population. It subsequently escaped from the reservoir and has been collected in both lotic and lentic environments downstream in the Platte and Missouri River drainages. In 1977 it was captured in Buckley IF, a flood control reservoir in the Little Blue

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002209 CONTINUED River drainage. Water from the Little Blue River eventually enters Tuttle Creek Reservoir and the Kansas River in Kansas. At present there are no barriers to prevent the white perch from spreading throughout the Kansas River drainage.

80-002210 Hickey, C. R., Jr. and J. W. Lester. MARINE FISHES OF SOUTHERN ORIGIN IN NEW YORK WATERS AND THEIR CONTRIBUTION TO THE FISHERY. *N.Y. Fish Game J.* 27(1):99-102. Jan. 1980. SFA 25(3)
[U.S. Nucl. Regulatory Comm., Washington, DC 20555]

80-002211 Hillis, D. M.; E. Milstead and S. L. Campbell. INLAND RECORDS OF *FUNDULUS GRANDIS* (CYPRINODONTIDAE) IN TEXAS. *Southwest. Nat.* 25(2):271-272. 15 May 1980. SFA 25(3)
[Strecker Mus., Baylor Univ., Waco, TX 76703]

80-002212 Jeffers, C. D. and E. J. Bacon. A DISTRIBUTIONAL SURVEY OF THE FISHES OF TEN MILE CREEK IN SOUTHEASTERN ARKANSAS. *Arkansas Acad. Sci. Proc.* 33:46-48. 1979. SFA 25(3)
[Biol. Dep., Univ. Ark., Monticello 71655]

80-002213 Kapp, H. RESULTS OF THE RESEARCH CRUISES OF FRV "WALTHER HERWIG" TO SOUTH AMERICA. LV. CHAETOGNATHA FROM THE PATAGONIAN SHELF IN FEBRUARY 1971. *Arch. Fischereiwiss.* 30(2-3):125-135. Mar. 1980. In English with German summ. SFA 25(3)
[Zool. Mus., Univ. Hamburg, West Germany]

80-002214 Konstantinov, K. G. and G. P. Nizovtsev. THE BASKING SHARK, *CETORHINUS MAXINUS*, IN KANDALAKSHA BAY OF THE WHITE SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):155-156. 1979. SFA 25(3)
[PINRO, Murmansk, USSR]

80-002215 Kristensen, J. and M. G. Foy. FIRST RECORD OF THE ROUND WHITEFISH IN ALBERTA. *Can. Field-Nat.* 94(2):180-182. Apr.-June 1980. SFA 25(3)
[LGL Ltd., Environ. Res. Assoc., 10110 124 St., Edmonton, AB T5N 1P6, Canada]

80-002216 Lehner, C. E. A LATITUDINAL GRADIENT ANALYSIS OF ROCKY SHORE FISHES OF THE EASTERN PACIFIC. *Ph.D. dissertation, Univ. Ariz.* 329p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5128. May 1980. SFA 25(3)

80-002217 McAda, C. W. and R. S. Wydoski. THE RAZORBACK SUCKER, *XYRAUCHEN TEXANUS*, IN THE UPPER COLORADO RIVER BASIN, 1974-76. *U.S. Fish Wildl. Serv. Tech. Pap.* 99. 15p. 1980. SFA 25(3)
[U.S. FWS, 447 East Main St., Vernal, UT 84078] The razorback sucker (*Xyrauchen texanus*), which has declined in abundance in the upper Colorado River primarily because of man's impact on the environment, has been recommended for listing as "threatened" in the U.S. Department of the Interior's list of threatened or endangered species. During the present investigation, razorback suckers were nevertheless found in relatively large concentrations at two restricted locations--the mouth of the Yampa River and a flooded gravel pit connected to the Colorado River near Grand Junction, Colorado. Razorback suckers spawned in April and May,

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002217 CONTINUED when water temperatures were 6 to 15 C. Estimated fecundity ranged from 24,490 eggs for a fish 529 mm in total length to 76,576 for a fish 485 mm long. Estimated ages based on scale examinations indicated that the razorback suckers collected had completed from 4 to 9 growing seasons; all were mature. Razorback suckers from the Colorado River were significantly larger than those of the same estimated age from the Green and Yampa rivers, probably because water temperature was higher in the Colorado River than in the other two streams.

80-002218 McCollum, J. L. and C. J. Quertermus. DISTRIBUTION OF FISHES IN THE DOG RIVER DRAINAGE. *Ga. J. Sci.* 38(1):55-63. Jan. 1980. SFA 25(3)
[C. J. Quertermus: Biol. Dep., West Ga. Coll., Carrollton 30118]

80-002219 Miller, R. R. "NATIVE" TROUT OF THE RIO YAQUI. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:39. 30 Jan. 1980. Abstract only. SFA 25(3)
[Univ. Mich., Ann Arbor] The three described trouts of the American Southwest are briefly reviewed. Preliminary observations are given on 13 samples of unidentified trout from Rio Yaqui and adjacent Rio Mayo, northern Mexico. A total of 154 specimens were collected between May and July 1978. Probably most, if not all, of these represent native stocks, although absolute purity cannot be determined for certain from preserved fish. These trout are more closely related to the rainbow than to the cutthroat series, and some osteological characters suggest a possible close relationship to *Salmo gilae*. Morphometric data and additional skeletal studies are needed as are the determination of karyotypes and biochemical traits before a confident identification will be possible.

80-002220 Morin, R.; J. Dodson and G. Power. ESTUARINE FISH COMMUNITIES OF THE EASTERN JAMES-HUDSON BAY COAST. *Environ. Biol. Fishes* 5(2):135-141. 22 Apr. 1980. SFA 25(3)
[J. Dodson: GIROQ, Dep. Biol., Univ. Laval, PQ G1K 7P4, Canada]

80-002221 Peden, A. E. OCCURRENCE OF THE EELPOUT, *BOTHROCARA PUSILLUM* (ZOARCIDAE), OFF BRITISH COLUMBIA. *Syesis* 12:183-184. 1979. SFA 25(3)
[Mar. Biol. Div., British Columbia Prov. Mus., Victoria, BC V8V 1X4, Canada]

80-002222 Peden, A. E. RARE CAPTURES OF TWO FISHES, *BENTHODESMUS* AND *PARALEPIS*, OFF BRITISH COLUMBIA. *Syesis* 12:179-180. 1979. SFA 25(3)
[Mar. Biol. Div., British Columbia Prov. Mus., Victoria, BC V8V 1X4, Canada]

80-002223 Post, A. and A. Svoboda. STRANDFUNDE MESOPELAGISCHER FISCHE AUS DEM GOLF VON AKABA. [ASHORE RECORDS OF MESOPELAGIC FISHES FROM THE GULF OF AQABA.] *Arch. Fischereiwiss.* 30(2-3):137-143. Mar. 1980. In German with English summ. SFA 25(3)
[Inst. Seefisch. Bundesforschungsanst. Fisch., Hamburg, West Germany]

80-002224 Post, A. RESULTS OF THE RESEARCH CRUISES OF FRV "WALTHER HERWIG" TO SOUTH AMERICA. LIV. NEW RECORDS OF EXTREMELY RARE PARALEPIDIDS FROM THE SOUTH ATLANTIC (OSTEICHTHYES, MYCTOPHIFORMES, ALEPISAUROIDEI).

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002224 CONTINUED *Arch. Fischereiwiss.* 30(2-3):121-124. Mar. 1980. In English with German summ. SFA 25(3)
[Inst. Seefisch. Bundesforschungsanst. Fisch., Hamburg, West Germany]

80-002225 Shcherbachev, Yu. N.; Yu. I. Sazonov and A. S. Piotrovskiy. ON THE DISCOVERY OF *TRACHONURUS VILLOSUS* AND SPECIES OF THE GENUS *MESOBIUS* (MACROURIDAE, OSTEICHTHYES) IN THE INDIAN OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):16-23. 1979. SFA 25(3)
[P. P. Shirshov Inst. Oceanol., USSR Acad. Sci., Moscow, USSR]

80-002226 Stein, D. L. and A. E. Peden. FIRST RECORD OF *PARALIPARIS PAUCIDENS* STEIN (PISCES: LIPARIDAE) FROM BRITISH COLUMBIA WATERS. *Syesis* 12:181. 1979. SFA 25(3)
[Mar. Biol. Div., British Columbia Prov. Mus., Victoria, BC V8V 1X4, Canada]

80-002227 Taylor, T. L. A BLUE CATFISH FROM THE SACRAMENTO-SAN JOAQUIN DELTA. *Calif. Fish Game* 66(2):120-121. Apr. 1980. SFA 25(3)
[Calif. Dep. Fish Game, 4001 N. Wilson Way, Stockton 95205]

80-002228 Tsepkin, Ye. A. LATE QUATERNARY ICHTHYOFAUNA OF THE ALDAN RIVER (LENA BASIN). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):23-27. 1979. SFA 25(3)
[Dep. Ichthyol., Univ. Moscow, USSR] The species composition of fish inhabiting the middle reaches of Aldan River at the end of the Pleistocene-Holocene is determined and their size reconstructed from fossil remains from the Dyuktay cave. Fishes of the same species and of similar size as present-day fishes inhabited the Aldan River in the late Pleistocene.

80-002229 U.S. Fish and Wildlife Service. SELECTED VERTEBRATE ENDANGERED SPECIES OF THE SEACOAST OF THE UNITED STATES. *U.S. Fish Wildl. Serv.* FWS/OBS-80/01. Mar. 1980. SFA 25(3)
[D. W. Woodard: U.S. FWS, Natl. Coastal Ecosyst. Team, 1010 Gause Blvd., Slidell, LA 70458]

80-002230 Vinikour, W. S. and R. V. Anderson. FIRST CONFIRMED RECORDS OF FISH (*COTTUS BAIRDI*) FROM TROUT PARK NATURE PRESERVE (ELGIN BOTANICAL GARDENS) SINCE PARK PERTURBATION BY I-90 CONSTRUCTION, 1957. *Trans. Ill. State Acad. Sci.* 72(2):97-99. 1979. SFA 25(3)
[Argonne Natl. Lab., Div. Environ. Impact Stud., Argonne, IL 60439]

80-002231 Wenner, C. A.; C. A. Barans; B. W. Stender and F. H. Berry. RESULTS OF MARMAP OTTER TRAWL INVESTIGATIONS IN THE SOUTH ATLANTIC BIGHT. IV. WINTER-EARLY SPRING 1975. *S.C. Mar. Resour. Cent. Tech. Rep.* No. 44. 59p. Dec. 1979. SFA 25(3)
[S.C. Wildl. Mar. Resour. Dep., Mar. Resour. Res. Inst., Charleston 29412]

80-002232 Zuck, W. H. and R. F. Denoncourt. FISHES OF THE YELLOW BREECHES CREEK DRAINAGE, CUMBERLAND AND YORK COUNTIES, PENNSYLVANIA. *Proc. Pa. Acad. Sci.* 53(2):161-168. 1979. SFA 25(3)
[Biol. Sci. Dep., York Coll. Pa., York, PA 19405]

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

80-002233 Black, G. THE STATUS OF THE DESERT PUPFISH, *CYPRINODON MACULARIUS*, AT THE SALTON SEA, CALIFORNIA. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:31-32. 30 Jan. 1980. Abstract only. SFA 25(3)
[1644 N. Humboldt Ave., Ontario, CA 91764]

80-002234 Dahlgren, B. T. INFLUENCES OF POPULATION DENSITY ON REPRODUCTIVE OUTPUT AT FOOD EXCESS IN THE GUPPY, *POECILIA RETICULATA* (PETERS). *Biol. Reprod.* 22(5):1047-1061. June 1980. SFA 25(3)
[Dep. Anim. Ecol., Univ. Lund, S-223 62 Lund, Sweden] Experiments were performed to investigate if population density and social facilitation may influence fecundity (number of ova produced per female) and fertility (number of intrafollicular embryos produced by a female) in the presence of excess food in the guppy, *Poecilia reticulata* (Teleostei: Poeciliidae). No significant differences in total body length, standard length and total body weight were found between females exposed to different population densities in the presence of excess food. The frequencies of females with only intrafollicular embryos or with only ova or with both embryos and ova in the ovary were not significantly different between groups at different population levels. This was also true for the frequency of females with only previtellogenic oocytes. There were no significant differences concerning ovarian length, width, height and volume between females from different population densities. This clear-cut result persisted also when gonad weight was examined. The average gonadosomatic index was highest in the highest population density. Highly significant correlations occurred between ovarian volume and total body weight as well as between ovarian volume and gonad weight at each population level ($P<0.001$, $P<0.01$). This was also the case for gonad weight vs total body weight ($P<0.001$, $P<0.01$). A significant and inverse correlation between fecundity and ovum diameter appeared only at the highest population level ($P<0.01$). No significant differences of fecundity and ovum diameter in addition to fertility and embryo size were revealed between different population densities when feeding ad libitum. This result differed from an earlier study in which increased population density caused a decrease in fecundity and fertility under conditions of food scarcity.

80-002235 Hubbs, C. THE SOLUTION TO THE *CYPRINODON BOVINUS* PROBLEM: ERADICATION OF A PUPFISH GENOME. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:9-18. 30 Jan. 1980. SFA 25(3)
[Dep. Zool., Univ. Tex., Austin 78712] The Leon Springs pupfish, *Cyprinodon bovinus*, is restricted to the Leon Creek watershed, Pecos County, Texas. *Cyprinodon variegatus* of unknown provenance released into the creek between January and August, 1974, produced a major hybrid swarm in the lower segment of Leon Creek and threatened the genic purity of the species. The extensive efforts that resulted in the elimination of phenotypic evidence of hybridization are documented.

80-002236 Kirksunov, Ye. A. and M. I. Shatunovskiy. SOME QUESTIONS OF POPULATION STRUCTURE VARIABILITY IN THE SMELT, *OSMERUS EPERLANUS*. *J. Ichthyol.* (*Engl. Transl. Vopr. Ikhtiol.*) 19(1):48-55. 1979. SFA 25(3)
[Dep. Ichthyol., Moscow Univ., USSR] A study was made of the factors and mechanisms determining the direction of changes in the population structure of the smelt, *Osmerus eperlanus*, during changes in the environment. On the basis of known data on the feeding of smelt in different areas changes are traced in the nature of the energy metabolism in separate forms of this species. The origin and adaptive significance of certain types of population dynamics in the species are explained from the bioenergetic point of view.

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

80-002237 Krokhin, Ye. M. and F. V. Krogius. PERIODIC FLUCTUATIONS IN THE LAKE DAL'NEYE ECOSYSTEM AND THEIR CONNECTION WITH SOLAR ACTIVITY RHYTHMS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):1-7. 1979. SFA 25(3)
[Kamchatka Dep., Pac. Res. Inst. Fish. Oceanogr., Petropavlovsk-Kamchatskiy, USSR] One of the major elements of the Lake Dal'neye ecosystem is the sockeye salmon, *Onchorhynchus nerka* which reproduces in this lake. Long-term observations, making it possible to apply the method of integral curves, have shown a strict correlation between the processes occurring in the ecosystem and in the actual sockeye population and a clear connection between the fluctuations in their abundance and the eleven-year rhythm in the changes of solar activity. This adaptation of the sockeye population to the entire ecosystem must be genetically consolidated.

80-002238 Smith, M. L. EL ESTADO ACTUAL DE *MEGUPSILON APORUS* Y *CYPRINODON ALVAREZI* DE EL POTOSI, NUEVO LEON. [THE STATUS OF *MEGUPSILON APORUS* AND *CYPRINODON ALVAREZI* AT EL POTOSI, NUEVO LEON.] *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:24-29. 30 Jan. 1980. In Spanish and English. SFA 25(3)
[Mus. Zool., Univ. Mich., Ann Arbor 48109] The isolated pond and springs at El Potosí, Nuevo León, constitute the only habitat of two unique pupfish species, *Negupsilon aporus* and *Cyprinodon alvarezi*, which are now threatened by the effects of groundwater pumping and predation and competition by introduced black bass. The pupfishes have been eliminated from parts of the main pond, but persist in a marginal marsh, lateral springs and irrigation ditches. Though populations were adequate in May, 1978, their restriction to peripheral habitats makes them susceptible to lowered water levels and other results of human activity. The long-term survival of the pupfishes will depend on careful management of their habitat.

80-002239 Ulanowicz, R. E. and T. T. Polgar. INFLUENCES OF ANADROMOUS SPAWNING BEHAVIOR AND OPTIMAL ENVIRONMENTAL CONDITIONS UPON STRIPED BASS (*MORONE SAXATILIS*) YEAR-CLASS SUCCESS. *Can. J. Fish. Aquatic. Sci.* 37(2):143-154. Feb. 1980. In English with French summ. SFA 25(3)
[Univ. Md., Chesapeake Biol. Lab., Solomons 20688]

80-002240 Vanicek, C. D. DECLINE OF THE LAKE GREENHAVEN SACRAMENTO PERCH POPULATION. *Calif. Fish Game* 66(3):178-183. July 1980. SFA 25(3)
[Dep. Biol. Sci., Calif. State Univ., Sacramento 95819] Fish populations at Lake Greenhaven were monitored by fall surveys from 1973 through 1978. The Sacramento perch has undergone a decline in abundance, growth, and condition, and has failed to reproduce in 3 of the last 4 years of the study. Other species, particularly the bluegill, have increased in abundance since 1973. Competitive interference by the bluegill population is suggested as the primary reason for the decline of the Sacramento perch population.

IDENTIFICATION, KEYS, CLASSIFICATION

80-002241 Andriyashev, A. P. and A. V. Neyelov. NEW SPECIES OF THE GENUS *PARALIPARIS* (LIPARIDAE) FROM THE WESTERN ANTARCTIC. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):7-15. 1979. SFA 25(3)
[Inst. Zool., USSR Acad. Sci., Lennigrad, USSR]

80-002242 Bills, F. T. and C. E. Bond. A NEW SUBSPECIES OF TUI CHUB (PISCES: CYPRINIDAE) FROM COWHEAD LAKE, CALIFORNIA. *Copeia* 1980(2):320-322. 1 May 1980. SFA 25(3)

IDENTIFICATION, KEYS, CLASSIFICATION (CONTINUED)

80-002242 CONTINUED
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331] A new subspecies of tui chub from an isolated slough in northeastern California is described. *Gila bicolor vaccaceps*, the Cowhead Lake tui chub, is distinguished by 19 to 25 short gill rakers, by 26 to 35 predorsal scales and a mean value of 15.52 pectoral-fin rays. Although Cowhead Lake once drained into Warner Valley, Oregon, *G. b. vaccaceps* is well-differentiated from the the chub of the latter basin.

80-002243 Bradbury, M. G. A REVISION OF THE FISH GENUS *OGCOCEPHALUS* WITH DESCRIPTONS OF NEW SPECIES FROM THE WESTERN ATLANTIC OCEAN (OGCOCEPHALIDAE; LOPHIIFORMES). *Proc. Calif. Acad. Sci.* 42(7):229-285. 2 July 1980. SFA 25(3)
[Dep. Ichthyol., Calif. Acad. Sci., Golden Gate Park, San Francisco 94118]

80-002244 Clark, E. RED SEA FISHES OF THE FAMILY TRIPTERYGIIDAE WITH DESCRIPTIONS OF EIGHT NEW SPECIES. *Isr. J. Zool.* 28(2/3):65-113. 1979. SFA 25(3)
[Dep. Zool., Univ. Md., College Park 20742]

80-002245 Cohen, D. M. NAMES OF THE HAKES. *Mar. Fish. Rev.* 42(1):2-3 Jan. 1980. SFA 25(3)
[NMFS, Natl. Mus. Nat. Hist., Washington, DC 20560]

80-002246 Fritzsche, R. A. REVISION OF THE EASTERN PACIFIC SYNGNATHIDAE (PISCES: SYNGNATHIFORMES), INCLUDING BOTH RECENT AND FOSSIL FORMS. *Proc. Calif. Acad. Sci.* 42(6):181-227. 2 July 1980. SFA 25(3)
[Dep. Biol., Univ. Miss., University 38677]

80-002247 Gaudant, J. SUR *AMIA KEHRERI* ANDREAE (POISSON AMIIDAE DU LUTÉTIEN DE MESSEL, ALLEMAGNE) ET SA SIGNIFICATION PALÉOGÉOGRAPHIQUE. [ON *AMIA KEHRERI* ANDREAE (AMIID FISH FROM THE LUTETIAN OF MESSEL, GERMANY) AND ITS PALAEOGEOGRAPHICAL SIGNIFICANCE.] *C. R. Seances Acad. Sci. Ser. D Sci. Nat.* 290(16):1107-1110. 28 Apr. 1980. In French with English summ. SFA 25(3)
[17, rue du Docteur-Magnan, 75013 Paris, France]

80-002248 Hardy, G. S. A REDESCRIPTION OF THE ANTITROPICAL PUFFERFISH *AROTHRON FIRMAMENTUM* (PLECTOGNATHI: TETRAODONTIDAE). *N.Z. J. Zool.* 7(1):115-125. 1980. SFA 25(3)
[Sch. Zool., Univ. New South Wales, P.O. Box 1, Kensington, N.S.W. 2033, Australia]

80-002249 Meyer, M. K. and M. Schartl. EINE NEUE *XIPHOPHORUS*-ART AUS VERA CRUZ, MEXIKO. [A NEW *XIPHOPHORUS* SPECIES FROM VERA CRUZ, MEXICO.] *Senckenbergiana Biol.* 60(3/4):147-151. 1980. In German with English summ. SFA 25(3)
[Schwalheimer Hauptstr. 221 D-6350 Bad Nauheim 6, West Germany]

80-002250 Morton, W. M. GOODBYE DOLLY. *Fisheries (Bull. Am. Fish. Soc.)* 5(3):17-21. May-June 1980. SFA 25(3)

IDENTIFICATION, KEYS, CLASSIFICATION (CONTINUED)

80-002251 Parin, N. V. *MELANOSTIGMA (BANDICHTHYS) VITIAZI* - A NEW DEEP-SEA FISH (MELANOSTIGMATIDAE, OSTEICHTHYES) FROM THE BANDA SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):150-153. 1979. SFA 25(3)
[P. P. Shirshov Inst. Oceanol., USSR Acad. Sci., Moscow, USSR]

80-002252 Poss, S. G. and W. N. Eschmeyer. *XENAPLOACTIS*, A NEW GENUS FOR *PROSOPODASYS ASPERRIMUS* GÜNTHER (PISCES: APLOACTINIDAE), WITH DESCRIPTIONS OF TWO NEW SPECIES. *Proc. Calif. Acad. Sci.* 42(8):287-293. 2 July 1980. SFA 25(3)
[Div. Biol. Sci., Univ. Mich., Ann Arbor 48109]

80-002253 Randall, J. E. REVISION OF THE FISH GENUS *PLECTRANTHIAS* (SERRANDIDAE: ANTHIINAE) WITH DESCRIPTIONS OF 13 NEW SPECIES. *Micronesica* 16(1):101-187. June 1980. SFA 25(3)
[Bernice P. Bishop Mus., Box 19000-A, Honolulu, HI 96819]

80-002254 Snelson, F. F., Jr. SYSTEMATIC REVIEW OF THE CYPRINID FISH, *NOTROPIS LIRUS*. *Copeia* 1980(2):323-334. 1 May 1980. SFA 25(3)
[Dep. Biol., Univ. Cent. Fla., P.O. Box 25000, Orlando 32816]

80-002255 Staeck, W. *CHROMIDOTILAPIA LINKEI* N. SP. AUS DEM MUNGO RIVER, KAMERUN. [*CHROMIDOTILAPIA LINKEI* N.SP. FROM THE RIVER MUNGO, CAMEROON.] *Senckenbergiana Biol.* 60(3/4):153-157. 1980. In German with English summ. SFA 25(3)
[Beymestr. 8, D-1000, Berlin 41, West Germany]

80-002256 Staeck, W. *PSEUDOTROPHEUS HETEROPICTUS* N.SP. AUS DEM MALAWI-SEE. [*PSEUDOTROPHEUS HETEROPICTUS* N.SP. FROM LAKE MALAWI.] *Senckenbergiana Biol.* 60(3/4):159-162. 1980. In German with English summ. SFA 25(3)
[Beymestr. 8, D-1000, Berlin 41, West Germany]

80-002257 Tokuya, K. and K. Amaoka. [STUDIES ON LARVAL AND JUVENILE BLENNIES IN THE COASTAL WATERS OF THE SOUTHERN HOKKAIDO (PISCES: BLENNIOIDEI).] *Bull. Fac. Fish. Hokkaido Univ.* 31(1):16-49. Mar. 1980. In Japanese with English summ. SFA 25(3)
[Lab. Mar. Zool., Fac. Fish., Hokkaido Univ., Minato-cho, Hakodate 041, Japan]

80-002258 Tortonese, E. ON SOME BUTTERFLY FISHES FROM THE RED SEA (PISCES, CHAETODONTIDAE). *Thalassographica* 3(1):35-42. Nov. 1979. In English with French and Greek summ. SFA 25(3)
[Ist. Zooprof., Genova, Italy]

PARASITES AND DISEASES-GENERAL

80-002259 Arthur, J. R. and H. P. Arai. STUDIES ON THE PARASITES OF PACIFIC HERRING (*CLUPEA HARENGUS PALLASI* VALENCIENNES): A PRELIMINARY EVALUATION OF PARASITES AS INDICATORS OF GEOGRAPHICAL ORIGIN FOR SPAWNING HERRING. *Can. J. Zool.* 58(4):521-527. Apr. 1980. In English with French summ. SFA 25(3)
[Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] A

PARASITES AND DISEASES-GENERAL (CONTINUED)

80-002259 CONTINUED preliminary analysis of parasites as biological indicators for spawning stocks of Pacific herring (*Clupea harengus pallasi* Valenciennes) occurring in coastal waters of British Columbia and adjacent areas of Washington and Alaska was conducted using the techniques of pattern recognition. Separation of stocks based on three parasites which best served as category separators (*Thynnascaris aduncа* (Rudolphi, 1802) larva; *Anisakis simplex* (Rudolphi, 1809) larva; and bucephalid metacercariae) using multicategory linear discriminant analysis and *k*-nearest neighbor analysis revealed good separation for only one locality (Port Gamble, Washington). Re-analysis using three subsets of collections based on geographical area (northern, central, and southern) gave substantially improved classification. Although reliable separation of adjacent stocks of spawning herring could not be accomplished, parasites may be useful in characterizing certain stocks of herring or for separation of stocks taken from more divergent geographical areas.

80-002260 Ghittino, P.; P. De Kinkelin and N. Fijan. THE INTERNATIONAL ZOO-SANITARY CODE AND FISH DISEASES. *Riv. It. Piscic. Ittiop.* 15(1):17-26. Jan.-Feb.-Mar. 1980. In English, French and Italian. SFA 25(3)
[Ist. Zooprof. Spec. Piemonte, Via Bologna 148, 10154 Torino, Italy]

80-002261 Liguori, V. M. THE GILL PARASITES OF THE WHITE PERCH, *MORONE AMERICANA*, FROM THE HUDSON RIVER AT VINCENT'S POINT. *M.S. thesis, Adelphi Univ.* 86p. 1979. From Masters Abstr. 18(2):84. June 1980. SFA 25(3)
One hundred and seventy-seven Hudson River white perch, *Morone americana*, were caught between June and November, 1978 and examined for the presence and distribution of gill parasites. Five species were recovered: the monogene *Urocleidus biramosus*; *Ergasilus labricus*, a copepod; *Lampsilis radiata* glochidia; the isopod *Lironeca ovalis*; and the metacercarial cysts of an unidentified trematode. A species of monogene egg was also found. All but the metacercariae followed seasonal patterns with various factors, including host spawning time, salinity changes due to host movement, and water temperature, seeming to take part in the seasonality observed. While an uneven pattern of distribution was observed for all five species, only some patterns were significant. All but the copepods had their greatest incidence on gill section B, while the incidence of all but the monogene was highest on gill arch one. These phenomena appear to be a result of the ventilation current.

80-002262 Pomales, A. D. and E. H. Williams, Jr. YEARLY PARASITE VARIATION IN THE TEMPERATE CENTRARCHID, *MICROPTERUS SALMOIDES* (LACÉPÈDE), LARGEMOUTH BASS, TWENTY-EIGHT YEARS AFTER INTRODUCTION INTO A TROPICAL ENVIRONMENT. *J. Parasitol.* 66(1):81. Feb. 1980. SFA 25(3)
[Dep. Mar. Sci., Univ. Puerto Rico, Mayaguez 00708]

BACTERIAL DISEASES

80-002263 Antipa, R.; R. Gould and D. F. Amend. *VIBRIO ANGUILLARUM* VACCINATION OF SOCKEYE SALMON *ONCORHYNCHUS NERKA* (WALBAUM) BY DIRECT AND HYPEROSMOTIC IMMERSION. *J. Fish Dis.* 3(2):161-165. Mar. 1980. SFA 25(3)
[D. F. Amend: Tavolek Inc., 2779 152nd Ave. N.E., Redmond, WA 98052]

80-002264 Bucke, D. A NOTE ON ACID-ALCOHOL-FAST BACTERIA IN MACKEREL *SCOMBER SCOMBRUS* L. *J. Fish Dis.* 3(2):173-175. Mar. 1980. SFA 25(3)
[Minist. Agric. Fish. Food, Fish Dis. Lab., The Nothe, Weymouth, Dorset DT4 8UB, England]

BACTERIAL DISEASES (CONTINUED)

80-002264 CONTINUED

80-002265 Elliott, D. G. and E. B. Shotts, Jr. AETIOLOGY OF AN ULCERATIVE DISEASE IN GOLDFISH *CARASSIUS AURATUS* (L.): MICROBIOLOGICAL EXAMINATION OF DISEASED FISH FROM SEVEN LOCATIONS. *J. Fish Dis.* 3(2):133-143. Mar. 1980. SFA 25(3)

[Coll. Fish., WH-10, Univ. Wash., Seattle 98195] A comparative diagnostic study was conducted on goldfish, *Carassius auratus* (L.), with a cutaneous ulcerative disease from five locations in the United States and one each in England and Japan. Fish were examined for parasites, viruses and bacteria. Fish from all locations examined were infested by ectoparasites; no single parasite species was common to all locations. No virus-associated cytopathology was observed in fathead minnow (FHM) or adult goldfish (CAR) monolayer cell cultures inoculated with homogenates of cutaneous lesions, kidneys and livers from diseased fish. The only bacterium cultured from fish from all locations was an atypical, often late-pigmenting strain of *Aeromonas salmonicida*. This organism was isolated from 64 of 83 (77%) of the total lesions cultured and was most prevalent in early lesions. A second commonly isolated organism was *Aeromonas hydrophila*, which was cultured from fish at four of the seven locations and from 28 (34%) of the total lesions cultured. *A. hydrophila* was most prevalent in terminal lesions. From these studies it was concluded that *A. salmonicida* was the probable cause of ulcers noted in the cases examined and that *A. hydrophila* was a secondary invader.

80-002266 Elliott, D. G. and E. B. Shotts, Jr. AETIOLOGY OF AN ULCERATIVE DISEASE IN GOLDFISH, *CARASSIUS AURATUS* (L.): EXPERIMENTAL INDUCTION OF THE DISEASE. *J. Fish Dis.* 3(2):145-151. Mar. 1980. SFA 25(3)

[Coll. Fish., WH-10, Univ. Wash., Seattle 98195] Infection experiments were conducted to determine the primary aetiology of an ulcerative disease in goldfish, *Carassius auratus* (L.). Goldfish were exposed to atypical *Aeromonas salmonicida* and *A. hydrophila*, previously isolated from cutaneous ulcers, and to 0.45 µm filtrates of cutaneous ulcers and kidneys from diseased fish. Fish were exposed to each preparation by intraperitoneal, intramuscular or subcutaneous injection and by a method in which a small patch of scales was removed from each side of the fish and the inoculum applied. Most of the fish injected with *A. salmonicida* died without developing cutaneous ulcers; however, ulcers were induced in five of the ten fish exposed by the scale removal technique. Exposure to ultrafiltrates or *A. hydrophila* did not result in consistent ulcer formation or death. Additional experiments showed that a 30-min exposure of goldfish, without prior treatment, to water containing 3×10^6 colony forming units (cfu/ml) of *A. salmonicida* was sufficient to produce cutaneous lesions in nine of ten fish exposed. Multiple lesions were produced in most fish and *A. salmonicida* was consistently recovered. Fish exposed by similar waterborne challenges to 6.2×10^6 cfu/ml of *A. hydrophila* or to 7.2×10^6 cfu/ml of another lesion isolate identified as a member of the *A. hydrophila* complex produced no lesions, even when scales were removed. The studies demonstrate that atypical *A. salmonicida* can initiate cutaneous lesions characteristic of ulcerative disease, while *A. hydrophila* and an *A. hydrophila* complex organism cannot.

80-002267 From, J. CHLORAMINE-T FOR CONTROL OF BACTERIAL GILL DISEASE. *Prog. Fish-Cult.* 42(2):85-86. Apr. 1980. SFA 25(3)

[Danish Trout Cult. Res. Stn., Broens, 6780 Skaerbaek, Denmark]

80-002268 Giavenni, R.; M. Finazzi; G. Poli and E. Grimaldi. TUBERCULOSIS IN MARINE TROPICAL FISHES IN AN AQUARIUM. *J. Wildl. Dis.* 16(2):161-168. Apr. 1980. SFA 25(3)

BACTERIAL DISEASES (CONTINUED)

80-002268 CONTINUED
[Ist. Anat. Patol. Vet. Patol. Aviare, Univ. delgi Stud., Milano, Italy] Skin, gill and visceral tubercle lesions were detected in marine tropical fish in an aquarium. Ninety-seven fish of 17 different genera were affected. The tubercles consisted of a wall of densely packed epithelioid cells and necrotic center packed with acid-fast bacilli identified as *Mycobacterium marinum*.

80-002269 Nikryakov, V. R. AGE-RELATED VARIABILITY IN THE ANTIMICROBIAL EFFECT OF THE BLOOD SERUM OF THE BREAM, *ABRAMIS BRAMA*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):143-149. 1979. SFA 25(3)
[Inst. Biol. Inland Waters, USSR Acad. Sci. Borok, Yaroslavl' Region USSR] The change in the level of the antimicrobial properties of the blood serum was studied in various age groups of the bream *Abramis brama*. The change in these indicators depends on age-related and individual features of the fish. Blood sera suppressed most actively the development of bacteria in fish aged 4+ to 10+; in individuals of more than 11 years old the activity decreased.

80-002270 Mitchell, A. J. and J. A. Plumb. TOXICITY AND EFFICACY OF FURANACE ON CHANNEL CATFISH *ICTALURUS PUNCTATUS* (RAFINESQUE) INFECTED EXPERIMENTALLY WITH *AEROMONAS HYDROPHILA*. *J. Fish Dis.* 3(2):93-99. Mar. 1980. SFA 25(3)
[J. A. Plumb: Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830] The 96-h medium tolerance limit of Furanace (nifurpirinol; P-7138) for channel catfish *Ictalurus punctatus* at 21°C was 0.94 mg/l. The most effective treatment level for channel catfish, experimentally infected with *Aeromonas hydrophila*, was 3 mg/l for 6.5 h. Furanace at 0.5 and 1.0 mg/l in brain heart infusion agar reduced *in vitro* growth of *A. hydrophila* and at 2.0 mg/l growth was completely inhibited. *In vitro* drug resistance was observed.

80-002271 Pyle, S. W. and E. B. Shotts, Jr. A NEW APPROACH FOR DIFFERENTIATING FLEXIBACTERIA ISOLATED FROM COLD-WATER AND WARMWATER FISH. *Can. J. Fish. Aquatic Sci.* 37(6):1040-1042. June 1980. In English with French summ. SFA 25(3)
[Dep. Med. Microbiol., Coll. Vet. Med., Univ. Ga., Athens 30602]

80-002272 Sanders, J. E. and J. L. Fryer. *RENIBACTERIUM SALMONINARUM* GEN. NOV., SP. NOV., THE CAUSATIVE AGENT OF BACTERIAL KIDNEY DISEASE IN SALMONID FISHES. *Int. J. Syst. Bacteriol.* 30(2):496-502. Apr. 1980. SFA 25(3)
[Dep. Microbiol., Oreg. State Univ., Corvallis 97331] Isolates of the kidney disease bacterium, the causative agent of bacterial kidney disease in salmonid fishes, were characterized by the guanine plus cytosine content of the deoxyribonucleic acid, by cell wall sugar composition, and by amino acid composition of the peptidoglycan cell wall layer. The guanine plus cytosine contents of the deoxyribonucleic acids of the isolates were 53 ± 0.46 mol%. Glucose was the principal cell wall sugar detected in each kidney disease bacterium isolate. The major amino acids detected were alanine, glutamic acid, lysine, and glycine. It is proposed that these organisms form a single species belonging to a new genus, for which the name *Renibacterium* is proposed. The type species is *Renibacterium salmoninarum* sp. nov., of which the type strain is Les-1-74 (= ATCC 33209). This organism is most closely related to the Coryneform Group of Bacteria.

80-002273 Shotts, E. B., Jr.; F. D. Talkington; D. G. Elliott and D. H. McCarthy. AETIOLOGY OF AN ULCERATIVE DISEASE IN GOLDFISH, *CARASSIUS AURATUS* (L.): CHARACTERIZATION OF THE CAUSATIVE AGENT. *J. Fish. Dis.*

BACTERIAL DISEASES (CONTINUED)

80-002273 CONTINUED 3(3):181-186. May 1980. SFA 25(3)
[Coll. Vet. Med., Univ. Ga., Athens] A bacterium resembling *Aeromonas salmonicida* and determined to be the aetiologic agent of a cutaneous ulcerative disease in goldfish *Carassius auratus* (L.) was further characterized in this study. Forty-five isolates of the bacterium (43 from the United States and one each from England and Japan) were compared with typical salmonid isolates of *A. salmonicida* using biochemical tests, antibiotic sensitivity tests, DNA base composition (moles % guanine plus cytosine) and DNA homolgy. The bacteriological properties of all the goldfish isolates were similar and consistent with those of some atypical *A. salmonicida* previously described. Several important biochemical characteristics distinguished the goldfish isolates from typical *A. salmonicida*, but the DNA binding experiments indicated a high degree of relatedness between the goldfish isolates and typical *A. salmonicida* strains.

PROTOZOAN DISEASES

80-002274 Farley, D. G. and R. Heckmann. ATTEMPTS TO CONTROL *ICHTHYOPHTHIRIUS MULTIFILIIS* FOUQUET (CHILIOPHORA: OPHRYOGLENIDAE) BY CHEMOTHERAPY AND ELECTROTHERAPY. *J. Fish. Dis.* 3(3):203-212. May 1980. SFA 25(3)
[Dep. Zool., Brigham Young Univ., Provo, UT] New methods were studied for the control of *Ichthyophthirius multifiliis* Fouquet, one of the most serious parasites of fish. Totals of 272 fish, *I. multifiliis* trophozoites and 562,500 tomites were used in the screening of amprolium, ronidizole, and silver nitrate for parasite control. In addition, 1,465 trophozoites and 600 tomites were subjected to pulsed DC electrotherapy trials. Silver nitrate at 0.67 ppm was 100% effective in eradicating tomites, while ronidizole at 750 ppm gave 100% and 97% control of trophozoites and tomites, respectively. Amprolium and electrotherapy were both ineffective against trophozoites and tomites. Silver nitrate has promise as a safe and effective alternative to chemicals currently used to control *I. multifiliis*.

80-002275 Kirmse, P. OBSERVATIONS ON THE PATHOGENICITY OF *HAEMOGREGARINA SACHAI* KIRMSE, 1978, IN FARMED TURBOT *SCOPHTHALMUS MAXIMUS* (L.). *J. Fish Dis.* 3(2):101-114. Mar. 1980. SFA 25(3)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] Cultured turbot *Scophthalmus maximus* (L.) from three farms at Hunterston, Scotland were found to be infected with *Haemogregarina sachai*. Up to 6% of some populations were affected with gross tumorous lesions of the musculature and viscera. The lesions consisted of necrotic tissue with a caseous centre. Histologically, there was an accumulation of parasitized reticulo-endothelial cells, cell debris and pyknotic nuclei. Parasitaemias of up to 36% of all blood cell types were observed. The majority of infected cells were neutrophils and monocytes. Infected leucocytes were hypertrophied. There was an erythrocytopenia of infected fish with increases in erythroblasts, monocytes and neutrophils but a decrease in thrombocytes and lymphocytes. Transmission experiments between fish were unsuccessful.

80-002276 Kosel, T. R.; M. Lott and B. Taylor. ISOLATION OF *MYXOSOMA CEREBRALIS* (WHIRLING DISEASE) SPORES FROM INFECTED FISH BY USE OF A PHYSICAL SEPARATION TECHNIQUE. *Can. J. Fish. Aquatic Sci.* 37(6):1032-1035. June 1980. In English with French summ. SFA 25(3)
[Dep. Microbiol., Univ. Nev., Reno 89557]

PROTOZOAN DISEASES (CONTINUED)

80-002277 MacLean, S. A. STUDY OF *HAEMATRACTIDIUM SCOMBRI* IN ATLANTIC MACKEREL, *SCOMBER SCOMBRUS*. *Can. J. Fish. Aquatic Sci.* 37(5):812-816. May 1980. In English with French summ. SFA 25(3)
[NMFS, Oxford, MD 21654]

80-002278 Mitchell, L. G.; J. K. Listebarger and W. C. Bailey. EPIZOOTIOLOGY AND HISTOPATHOLOGY OF *CHLOROMYXUM TRIJUGUM* (MYXOSPORA: MYXOSPORIDA) IN CENTRARCHID FISHES FROM IOWA. *J. Wildl. Dis.* 16(2):233-236. Apr. 1980. SFA 25(3)
[Dep. Zool., Iowa State Univ., Ames 50011] The gall bladder parasite, *Chloromyxum trijugum*, shows marked host specificity within the sunfish family Centrarchidae. During 1977-78 80% of 230 bluegills (*Lepomis macrochirus*) in Iowa were infected. Prevalence in green sunfish (*L. cyanellus*) was lower (17%); one of 2 specimens of the hybrid *L. macrochirus* X *L. cyanellus* was infected; orangespotted sunfish (L. humilis) and hybrids (*L. humilis* X *L. macrochirus*) were not infected. Intensity of infection in bluegills varied throughout the year. Prevalence of free-floating plasmodia in bluegill gall bladders was highest (100%) during winter and spring months, and decreased to 40-50% during summer and fall. Prevalence of attached plasmodia may remain 80-100% throughout the year. Sporulation and plasmotomy were observed year-round. Plasmodia were attached to underlying epithelial cells by pseudopodia-like projections and were associated with various stages of breakdown in the mucosal layer.

80-002279 Seagrave, C. P.; D. Bucke and D. J. Alderman. ULTRASTRUCTURE OF A HAPLOSPOREAN-LIKE ORGANISM: THE POSSIBLE CAUSATIVE AGENT OF PROLIFERATIVE KIDNEY DISEASE IN RAINBOW TROUT. *J. Fish Biol.* 16(4):453-459. Apr. 1980. SFA 25(3)
[Fish Dis. Lab., Weymouth, Dorset, England]

80-002280 Siau, Y. OBSERVATION IMMUNOLOGIQUE SUR DES POISSONS DU GENRE *MUGIL* PARASITES PAR LA MYXOSPORIDIE *MYXOBOLUS EXIGUUS* THÉLOHAN, 1895. [IMMUNOLOGIC OBSERVATIONS IN FISHES OF THE GENUS *MUGIL* PARASITIZED BY THE MYXOSPORIDAN *MYXOBOLUS EXIGUUS* THÉLOHAN, 1895.] *Z. Parasitenkd.* 62(1):1-6. 1980. In French with English summ. SFA 25(3)
[Lab. Ichthyol. Parasitol. Gen., Univ. Sci. Tech. Lang., Place E. Bataillon, F-34060 Montpellier, France]

80-002281 Siau, Y. OBSERVATION IMMUNOLOGIQUE SUR DES POISSONS DU GENRE *MUGIL* PARASITES PAR LA MYXOSPORIDIE *MYXOBOLUS EIGUUS* THÉLOHAN, 1895. [IMMUNOLOGIC OBSERVATIONS IN FISHES OF THE GENUS *MUGIL* PARASITIZED BY THE MYXOSPORIDAN *MYXOBOLUS EXIGUUS* THÉLOHAN, 1895.] *Z. Parasitenkd.* 62(1):1-6. 1980. In French with English summ. SFA 25(3)
[Lab. Ichthyol. Parasitol. Gen., Univ. Sci. Tech. Lang., Place E. Bataillon, F34060 Montpellier, France]

80-002282 Smith, C. E. and T. Inslee. INTERLAMELLAR *HENNEGUYA* INFESTATION IN ADULT CHANNEL CATFISH *ICTALURUS PUNCTATUS* (RAFINESQUE). *J. Fish. Dis.* 3(3):257-260. May 1980. SFA 25(3)
[U.S. FWS, Fish Cult. Dev. Cent., Bozeman, MT 59715]

80-002283 Wehnert, S. D. and P. T. K. Woo. *IN VIVO* AND *IN VITRO* STUDIES ON THE HOST SPECIFICITY OF *TRYPANOPLASMA SALMOSITICA*. *J. Wildl. Dis.* 16(2):183-187. Apr. 1980. SFA 25(3)

PROTOZOAN DISEASES (CONTINUED)

80-002283 CONTINUED
[P. T. K. Woo: Dep. Zool., Univ. Guelph, Guelph, ON, Canada] The host specificity of *Trypanoplasma salmositica* was studied by experimental inoculation into 13 species of common teleosts (*Notropis cornutus, Notropis heterolepis, Notropis spilopterus, Nocomis biguttatus, Rhinichthys atratulus, Semotilus atromaculatus, Carassius auratus, Ambloplites rupestris, Lepomis gibbosus, Etheostoma nigrum, Hypentelium nigricans, Ictalurus melas,* and *Eucalia inconstans*). *T. salmositica* was not recovered at 14 and 40 days post inoculation. However, large numbers of the parasite were recovered from *Salmo gairdneri* and *Cottus cognatus*, thus indicating that sculpins might be reservoir hosts in certain areas where salmonids and sculpins occur in close proximity. Using a modified *In Vitro* Plasma Incubation Technique, it was shown that the plasma of refractory fishes had lytic ability and the titer ranged from 1:4 to 1:8. Undiluted fresh plasma of goldfish and of the northern hog sucker lysed about 500 parasites within 30 to 60 mins at 4C. This lytic ability of fresh plasma was heat labile and partial coagulation of the blood also reduced the lytic liter. This study showed that *Trypanoplasma salmositica* was more host specific than originally reported. It was suggested that the mechanism responsible for providing the innate immunity to this parasite in some fishes was the Alternate Pathway of Complement Activation.

VIRAL DISEASES

80-002284 Agrawal, N. K. and C. L. Mahajan. NUTRITIONAL DEFICIENCY DISEASE IN AN INDIAN MAJOR CARP, *CIRRHINA MRIGALA* HAMILTON, DUE TO AVITAMINOSIS C DURING EARLY GROWTH. *J. Fish. Dis.* 3(3):231-248. May 1980. SFA 25(3)
[Aquatic Fish Biol. Lab., Dep. Zool., Univ. Rajasthan, Jaipur, India] Experiments with a purified vitamin test diet on newly hatched *Cirrhina mrigala* Hamilton, a major carp of great piscicultural importance, are reported. Experimentally induced vitamin C deficiency for 330 days was followed by recovery treatment for 30 days. Retarded growth and greater mortality accompanied by structural deformities such as lordosis and scoliosis, increasing with prolonged deficiency, were recorded. Haematological and haematopoietic studies revealed hypochromic macrocytic anaemia accompanied by anisocytosis. Correlated studies on erythropoiesis revealed increased reticulocytes and an overall decrease in small lymphoid haemoblasts. Total and differential leucocyte counts revealed leucopenia and thrombopenia accompanied by an increase in neutrophils and eosinophils. Recovery treatment halted and in some cases even compensated these pathophysiological changes to some extent.

80-002285 Bowser, P. R. and J. A. Plumb. GROWTH RATES OF A NEW CELL LINE FROM CHANNEL CATFISH OVARY AND CHANNEL CATFISH VIRUS REPLICATION AT DIFFERENT TEMPERATURES. *Can. J. Fish. Aquatic Sci.* 37(5):871-873. May 1980. In English with French summ. SFA 25(3)
[Univ. Calif., Bodega Mar. Lab., Bodega Bay 94923]

80-002286 MacMillan, J. R. and D. Mulcahy. VIRAL ERYTHROCYTIC NECROSIS: SOME PHYSIOLOGICAL CONSEQUENCES OF INFECTION IN CHUM SALMON (*ONCORHYNCHUS KETA*). *Can. J. Fish. Aquatic Sci.* 37(5):799-804. May 1980. In English with French summ. SFA 25(3)
[Natl. Fish. Res. Cent., Bldg. 204, NSA, Seattle, WA 98115]

VIRAL DISEASES (CONTINUED)

80-002287 Meyers, T. R. EXPERIMENTAL PATHOGENICITY OF REOVIRUS $13P_2$ FOR JUVENILE AMERICAN OYSTERS *CRASSOSTREA VIRGINICA* (GMELIN) AND BLUEGILL FINGERLINGS *LEPOMIS MACROCHIRUS* (RAFINESQUE). *J. Fish. Dis.* 3(3):187-201. May 1980. SFA 25(3)
[Dep. Avian Aquatic Anim. Med., N.Y. State Coll. Vet. Med., Cornell Univ., Ithaca]

80-002288 Paperna, I.; J. G. Harrison and G. W. Kissil. PATHOLOGY AND HISTOPATHOLOGY OF A SYSTEMIC GRANULOMA IN *SPARUS AURATA* (L.) CULTURED IN THE GULF OF AQABA. *J. Fish. Dis.* 3(3):213-221. May 1980. SFA 25(3)
[J. G. Harrison: MRCVS, Irest. Aquacult., Univ. Stirling, Stirling FK9 4LA, Scotland] A chronic inflammatory disease which has occurred amongst cultured *Sparus aurata* (L.) in Israel is described. The early pathological process is localized in the trunk kidney with focal necrosis, degenerative changes and obstruction of uriniferous ducts by calculi containing tyrosine. Subsequent granuloma formation leads to hypertrophy of the kidney and spleen and inflammatory and necrotic lesions may also be found in liver, gut wall, mesenteries, heart, eyes and other tissues. The diseases represents a significant cause of losses amongst cultured *S. aurata*.

OTHER DISEASES AND PARASITES

80-002289 Ahmed, A. T. A. and S. Egusa. DERMAL FIBROSARCOMA IN GOLDFISH *CARASSIUS AURATUS* (L.). *J. Fish. Dis.* 3(3):249-254. May 1980. SFA 25(3)
[Dep. Zool., Univ. Dacca, Bangladesh]

80-002290 Beverley-Burton, M. and D. M. Suriano. *CLEIDODISCUS ROBUSTUS* MUELLER, 1934 (MONOGENEA: ANCYROCEPHALINAE) FROM *LEPOMIS GIBBOSUS* L. (PISCES: CENTRARCHIDAE) IN ONTARIO, CANADA: ANATOMY AND SYSTEMATIC POSITION. *Can. J. Zool.* 58(4):654-660. Apr. 1980. In English with French summ. SFA 25(3)
[Dep. Zool., Coll. Biol. Sci., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-002291 Beverley-Burton, M. and D. M. Suriano. *HAPLOCLEIDUS DISPAR* (MUELLER, 1936) AND *PTEROCLEIDUS ACER* (MUELLER, 1936) (MONOGENEA: ANCYROCEPHALINAE) FROM *LEPOMIS GIBBOSUS* L. (PISCES: CENTRARCHIDAE) IN ONTARIO, CANADA: ANATOMY AND SYSTEMATIC POSITION. *Can. J. Zool.* 58(4):661-669. Apr. 1980. In English with French summ. SFA 25(3)
[Dep. Zool., Coll. Biol. Sci., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-002292 Bilqees, F. M. DESCRIPTION OF THREE TREMATODES INCLUDING TWO NEW SPECIES FROM THE FISHES OF KALRI LAKE, SIND, PAKISTAN. *Pak. J. Sci. Res.* 31(3-4):220-222. 1979. SFA 25(3)
[Sch. Parasitol., Dep. Zool., Univ. Karachi, Karachi-32, Pakistan]

80-002293 Bilqees, F. M. THREE TREMATODES INCLUDING TWO NEW SPECIES FROM FISHES OF THE KARACHI COAST. *Zool Scr.* 9(2):89-91. 1980. SFA 25(3)
[Sch. Parasitol., Dep. Zool., Univ. Karachi, Karachi, Pakistan]

80-002294 Burn, P. R. DENSITY DEPENDENT REGULATION OF A FISH TREMATODE POPULATION. *J. Parasitol.* 66(1):173-174. Feb. 1980. SFA 25(3)
[Osborn Lab. Mar. Sci., N.Y. Aquarium, N.Y. Zool. Soc., Boardwalk at W. 8th St., Brooklyn 11224]

OTHER DISEASES AND PARASITES (CONTINUED)

80-002295 Camp, J. W., Jr. and H. W. Huizinga. SEASONAL POPULATION INTERACTIONS OF *ACANTHOCEPHALUS DIRUS* (VAN CLEAVE 1931) IN THE CREEK CHUB, *SEMOTILUS ATROMACULATUS*, AND ISOPOD, *ASELLUS INTERMEDIUS*. *J. Parasitol.* 66(2):299-304. Apr. 1980. SFA 25(3)
[Dep. Biol., Wake Forest Univ., Winston-Salem, NC 27109]

80-002296 Canning, E. U. and A. C. Olson, Jr. *NOSEMA LEPOCREADII* SP. N., A PARASITE OF *LEPOCREADIUM MANTERI* (DIGENEA: LEPOCREADIIDAE) FROM THE GUT OF THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*. *J. Parasitol.* 66(1):154-159. Feb. 1980. SFA 25(3)
[Dep. Zool., Imperial Coll., London SW7 2AZ, England]

80-002297 Carvajal G., J. and R. A. Campbell. IDENTIFICACIÓN DE LAS LARVAS DE CESTODOS TETRARÍNQUIDOS PRESENTES EN LAS MERLUZAS Y CONGRIOS DE PUERTO MONTT, CHILE. [IDENTIFICATION OF TRYPANORHYNCH PLEROCERCI PRESENT IN HAKES AND REDFISH CUSK-EELS FROM PUERTO MONTT, CHILE.] *Bol. Chil. Parasitol.* 34(3-4):65-67. 1979. In Spanish with English summ. SFA 25(3)
[Lab. Zool., Inst. Cienc. Biol., Univ. Católi. Chile, Casilla 114-D, Santiago, Chile]

80-002298 Cloutman, D. G. TWO NEW SPECIES OF *DACTYLOGYRUS* (MONOGENEA: DACTYLOGYRIDAE) FROM *NOTROPIS SCABRICEPS* (COPE) AND *N. SCEPTICUS* (JORDAN AND GILBERT) (PISCES: CYPRINIDAE). *J. Parasitol.* 66(1):160-161. Feb. 1980. SFA 25(3)
[Duke Power Co. Environ. Lab., Rt. 4, Box 531, Huntersville, NC 28078]

80-002299 Cone, D. K. THE MONOGENEA OF SOME FRESHWATER FISHES IN NEW BRUNSWICK, CANADA. *J. Parasitol.* 66(1):178-180. Feb. 1980. SFA 25(3)
[Dep. Biol., Univ. New Brunswick, Fredericton, NB E3B 5A3, Canada]

80-002300 Crosby, M. D. and K. Smith. SEASONAL INCIDENCE OF *PHILOMETRA* SP. AND OTHER INTERNAL HELMINTHS IN BLUEGILL (*LEPOMIS MACROCHIRUS*) FROM LAKE CARROLL. *Ga. J. Sci.* 38(2):88. Apr. 1980. Abstract only. SFA 25(3)
[West Ga. Coll., Carrollton] During summer (1978) and fall (1979) *Lepomis macrochirus*, the bluegill sunfish, was collected from Lake Carroll, Carrollton, Georgia and examined for internal helminths. The parasitic burden for the fall collection was as follows: digenetic trematodes; *Posthodiplostomum minimum* (metacercaria), mean 7.2, range 0 to 33; nematodes: *Philometra* sp., mean 3.5, range 0 to 19; *Camallanus oxycephalus*, mean 0.3, range 0 to 10; cestodes, mean 0.7, range 0 to 7. The total worm burden for the fall (mean of 12.0) was approximately one-half that of the summer (mean of 22.4). *P. minimum* showed a decrease from a mean of 12.5 for the summer to a mean of 7.2 for the the fall. Bluegills were not parasitized by *Philometra* sp. during the summer, yet in the fall 5 fish were infected. During the summer, *C. oxycephalus* was prevalent (mean of 7.4), but seems to disappear by the fall. The data suggest a seasonal flux for certain internal helminths.

80-002301 Davies, A. J. SOME OBSERVATIONS ON *HAEMOHORNIDIUM COTTI* HENRY 1910, FROM THE MARINE FISH *COTTUS BUBALIS* EUPHRASEN. *Z. Parasitenkd.* 62(1):31-38. 1980. SFA 25(3)
[Dep. Zool., Univ. Coll. Wales, Aberiptwyth, SY23 3DA, Wales] *Haemohormidium cotti*, an organism of uncertain status, is redescribed from one of its type hosts, the marine fish, *Cottus bubalis*. The parasite

OTHER DISEASES AND PARASITES (CONTINUED)

80-002301 CONTINUED occurs as irregularly round, oval, or elongate, intraerythrocytic bodies within blood and tissue preparations. Electron micrographs show features which suggest that *H. cotti* may, as previously suspected, belong with the Piroplasmasida but no firm evidence of this is established. Possible division stages are identified in both light and electron micrographs. The taxonomic position of *Haemohormidium* is discussed.

80-002302 Davies, A. J. SOME OBSERVATIONS ON *HAEMOHORMIDIUM COTTI* HENRY 1910, FROM THE MARINE FISH *COTTUS BUBALIS* EUPHRASEN. *Z. Parasitenkd.* 62(1):31-38. 1980. SFA 25(3)
[Dep. Zool., Univ. Coll. Wales, Aberystwyth, SY23 3DA, Wales] *Haemohormidium cotti*, an organism of uncertain status, is redescribed from one of its type hosts, the marine fish, *Cottus bubalis*. The parasite occurs as irregularly round, oval, or elongate, intraerythrocytic bodies within blood and tissue preparations. Electron micrographs show features which suggest that *H. cotti* may, as previously suspected, belong with the Piroplasmasida but no firm evidence of this is established. Possible division stages are identified in both light and electron micrographs. The taxonomic position of *Haemohormidium* is discussed.

80-002303 Delves-Broughton, J.; J. K. Fawell and D. Woods. THE FIRST OCCURRENCE OF 'CAULIFLOWER DISEASE' OF EELS *ANGUILLA ANGUILLA* L. IN THE BRITISH ISLES. *J. Fish. Dis.* 3(3):255-256. May 1980. SFA 25(3)
[RHM Research Ltd., High Wycombe, Buckinghamshire, England]

80-002304 Dowsett, J. A. *CLINOSTOMUM COMPLANATUM* OR *CLINOSTOMUM MARINGATUM*? (TREMATODA: CLINOSTOMATIDAE). A PROBLEM OF PRIORITY AND SYNONYMY. *Can. J. Zool.* 58(4):680-682. Apr. 1980. In English with French summ. SFA 25(3)
[Dep. Biol., Univ. Winnipeg, Winnipeg, MB, Canada]

80-002305 Ferguson, H. W. and D. A. Rice. POST-SPAWNING MORTALITIES IN BROWN TROUT *SALMO TRUTTA* L. *J. Fish Dis.* 3(2):153-160. Mar. 1980. SFA 25(3)
[Dep. Pathol., Ontario Vet. Coll., Univ. Guelph, Guelph, ON N1G 2W1, Canada] An 'oedema syndrome' caused mortality of 55.5% in brood brown trout approximately 2 months after spawning. The pathology and clinical biochemistry of the condition are described. It is suggested that the severe hypoproteinaemia and anaemia were due mainly to the traditional reduction in feed levels prior to spawning at a time when the water temperatures were abnormally high. It is also suggested, however, that the syndrome would not have occurred if the fish had not developed an aeromonad infection prior to stripping. Concurrent fungal infection and subsequent extremely low water temperatures are also thought to have played a role.

80-002306 Ghittino, P.; E. Beccaria and A. Ferrari. CASO DI ASCITE INFETTIVA DELLA CARPA MODERNAMENTE DIAGNOSTICATO ANCHE IN ITALIA. [COMMENTS ON A CASE REPORT OF CARP INFECTIOUS DROPSY DIAGNOSED IN ITALY ALSO BY MODERN METHODS.] *Riv. It. Piscic. Ittiop.* 15(1):1-4. Jan.-Feb.-Mar. 1980. In Italian with English summ. SFA 25(3)
[Ist. Zooprof. Spec. Piemonte, Via Bologna 148, 10154 Torino, Italy] The authors commented an outbreak of Infectious Dropsy in Carp (IDC) occurred in common carp fingerlings kept in a pond before releasing it into rice fields in Italy. The disease appeared with all the signs of "Acute IDC or Spring Viraemia of Carp, SVC" and the classical *Rhabdovirus carpio* (its identification has been possible with the help kindly provided by N.N. Fijan, Zegreb, YU) has been isolated. In spite of the high occurrence of

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80-002306 CONTINUED IDC in the country, no recognition of this virus was previously demonstrated. The authors preferred to keep the denomination of IDC, instead to split it in SVC and Carp Erythrodermatitis (CE), since in all practical observations performed in Italy the disease appeared unseverable. During spring times, the acute form with dropsical conditions occurs joined with ulcers or boils; later on, the survivors in the infected groups develop typical ulcers. It is realized that fastidious modern diagnostic methods (virological + bacteriological) are right now necessary to provide a scientifical diagnosis of this carp disease which, meanwhile, became well established in the country.

80-002307 Hayunga, E. G. TWO ATYPICAL LESIONS FROM WHITE SUCKERS *CATOSTOMUS COMMERSONI* LACÉPÈDE INFECTED BY CARYOPHYLLID TAPEWORMS. *J. Fish Dis.* 3(2):167-172. Mar. 1980. SFA 25(3)
[Biomed. Res. Inst., Am. Found. Biol. Res., 12111 Parklawn Dr., Rockville, MD 20852]

80-002308 Keith, J. H. and L. M. Gray. A PRELIMINARY STUDY OF THE OCCURRENCE OF BROKEN BACK SYNDROME IN NORTHERN CAVEFISH (*AMBLYOPSIS SPELAEA* DEKAY) AT SPRING MILL STATE PARK, MITCHELL, INDIANA. *Proc. Indiana Acad. Sci.* 88:163. 1979. Abstract only. SFA 25(3)
[Div. Nat. Preserves, Indiana Dep. Nat. Resour., Indianapolis] In July 1976, the staff of Spring Mill State Park noted that several individuals of Northern Cavefish in Upper Twin Cave were apparently injured. Subsequent examination of the fish by a biologist from the U.S. Fish & Wildlife Service Laboratory in Genoa, Wisconsin indicated that the fish probably suffered from "Broken Back Syndrome", a condition in which vertebrae crack and extensive hemorrhaging results. This syndrome occurs under a variety of circumstances including physical trauma, vitamin C deficiency, and exposure to pesticides. Some preliminary work by the Indiana State Board of Health revealed the presence of toxaphene in the stream water of Upper Twin Cave. Results published by other investigators suggest that exposure of fish to toxaphene and related compounds alters the ratio of coldagen: mineral in the skeleton. Bones become brittle and crack easily, resulting in a broken back and associated hemorrhaging. In the summer of 1977, a similar condition was found. Using funds provided by Indiana's Division of Fish and Wildlife, it was decided to systematically survey the blind fish population and measure the pesticide content (toxaphene and dieldrin) of the stream water on a regular basis. In the summer of 1978, water samples were taken from Upper Twin Cave and analyzed for the presence of pesticides. Samples were taken bi-weekly and during major floods. Five visual censuses of the fish population were implemented to note any changes in the incidence of the syndrome over a two year period. Individual fish were also collected for chemical analysis. A comparison of recent census data from Upper Twin Cave with data taken from the same cave by Poulson (unpublished) in 1958 and 1964 does not demonstrate an adverse impact on the population at this time. However, the water analyses point to the need for further investigation and monitoring of this system. The potential impact of continued pesticide contamination of the cave water will be discussed along with the need for further study.

80-002309 Kranz, H.; N. Peters; G. Bresching and H. F. Stich. ON CELL KINETICS IN SKIN TUMOURS OF THE PACIFIC ENGLISH SOLE *PAROPHRYS VETULUS* GIRARD. *J. Fish Dis.* 3(2):125-132. Mar. 1980. SFA 25(3)
[Zool. Inst. Univ. Hamburg, Martin-Luther-King-Platz 3, 2000 Hamburg 13, West Germany]

OTHER DISEASES AND PARASITES (CONTINUED)

80-002310 Meyers, T. R.; R. E. Millemann and C. A. Fustish. GLOCHIDIOSIS OF SALMONID FISHES. IV. HUMORAL AND TISSUE RESPONSES OF COHO AND CHINOOK SALMON TO EXPERIMENTAL INFECTION WITH *MARGARITIFERA MARGARITIFERA* (L.) (PELECYPODA: MARGARITANIDAE). *J. Parasitol.* 66(2):274-281. Apr. 1980. SFA 25(3)
[Dep. Avian Aquatic Anim. Med., N.Y. State Coll. Vet. Med., Cornell Univ., Ithaca 14853]

80-002311 Muzzall, P. M. POPULATION BIOLOGY AND HOST-PARASITE RELATIONSHIPS OF *TRIGANODISTOMUM ATTENUATUM* (TREMATODA: LISSORCHIIDAE) INFECTING THE WHITE SUCKER, *CATOSTOMUS COMMERSONI* (LACÉPÈDE). *J. Parasitol.* 66(2):293-298. Apr. 1980. SFA 25(3)
[Dep. Zool., Univ. N.H., Durham 03824]

80-002312 Muzzall, P. M. ECOLOGY AND SEASONAL ABUNDANCE OF THREE ACANTHOCEPHALAN SPECIES INFECTING WHITE SUCKERS IN SE NEW HAMPSHIRE. *J. Parasitol.* 66(1):127-133. Feb. 1980. SFA 25(3)
[Dep. Nat. Sci., Kedzie Lab., Mich. State Univ., East Lansing 48824]

80-002313 Narasimhamurti, C.; C. Kalavati and B. Saratchandra. *MYXOSOMA MICROSPORA* N. SP. (MYXOSPORIDIA: PROTOZOA) PARASITIC IN THE GILLS OF *MUGIL CEPHALUS* L. *J. Fish Biol.* 16(4):345-348. Apr. 1980. SFA 25(3)
[Dep. Zool., Andhra Univ., Waltair, India]

80-002314 Pierce, K. V.; B. B. McCain and S. R. Wellings. HISTOPATHOLOGY OF ABNORMAL LIVERS AND OTHER ORGANS OF STARRY FLOUNDER *PLATICHTHYS STELLATUS* (PALLAS) FROM THE ESTUARY OF THE DUWAMISH RIVER, SEATTLE, WASHINGTON, U.S.A. *J. Fish Dis.* 3(2):81-91. Mar. 1980. SFA 25(3)
[B. B. McCain: Environ. Conserv. Div., NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Starry flounder *Platichthys stellatus* (Pallas) from the Duwamish River estuary, which has received large volumes of pollutants in the past, and starry flounder from two relatively unpolluted reference areas were examined for pathological conditions. Gross and microscopic examination of starry flounders from the Duwamish River estuary revealed one or more of the following unusual liver characteristics in 92% (monthly range 85-100%) of the fish: liver discolouration, liver enlargement, severe fatty vacuolation of the hepatocytes, centrolobular cellular degeneration and necrosis of hepatocytes, megalocytic hepatocytes, proliferating perivascular fibroblasts displacing adjacent liver parenchyma, hepatic structural disarray and increased basophilia of hepatocytes in localized areas. Livers of starry flounders, usually spent spawners, from one of the reference areas also had one or more of these characteristics, although at a much lower frequency (<13%), and these included liver discolouration, increased fatty vacuolation of the hepatocytes and hepatic structural disarray.

80-002315 Rosen, R. A. and D. C. Hales. OCCURRENCE OF SCARRED PADDLEFISH IN THE MISSOURI RIVER, SOUTH DAKOTA-NEBRASKA. *Prog. Fish-Cult.* 42(2):82-85. Apr. 1980. SFA 25(3)
[Mass. Coop. Fish. Res. Unit, Univ. Mass., Amherst 01003]

80-002316 Sharma, R. K. and P. K. Sharma. A NEW NEMATODE *NEOCAMALLANUS BAREILLIENSIS* FROM A PISCINE HOST *CHANNA PUNCTATUS* BLOCH. *J. Helminthol.* 54(1):21-23. Mar. 1980. SFA 25(3)
[Dep. Zool., Bareilly Coll., Bareilly, U.P., India]

OTHER DISEASES AND PARASITES (CONTINUED)

80-002317 Soto M., J. and J. Carvajal G. PARÁSITOS CESTODOS DE ALGUNOS PECES COMERCIALES DE ANTOFAGASTA, CHILE. [CESTODE PARASITES IN SOME COMMERCIAL FISHES FROM ANTOFAGASTA, CHILE.] *Bol. Chil. Parasitol.* 34(3-4):67-71. 1979. SFA 25(3)
[Grupo Microbiol. Parasitol., Dep. Salud, Univ. Chile, Sede Antofagasta, Casilla 1240, Antofagasta, Chile]

80-002318 Wabuke-Bunoti, M. A. N. THE PREVALENCE AND PATHOLOGY OF THE CESTODE *POLYONCHOBOTHRIUM CLARIAS* (WOODLAND, 1925) IN THE TELEOST, *CLARIAS MOSSAMBICUS* (PETERS). *J. Fish. Dis.* 3(3):223-230. May 1980. SFA 25(3)
[Dep. Genet., Univ. Minn., St. Paul 55108] The prevalence and pathology of the pseudophyllidean cestode, *Polyonchobothrium clarias* in the gastrointestinal tract of the teleost, *Clarias mossambicus* have been studied. The cestodes were most abundant in the gall bladder where they caused pronounced nodular outgrowths in the mucosa and exhibited a gradual decrease in number distally towards the rectum. Generally the intensity of the infection due to *P. clarias* was higher in young fish than in old fish.

POLLUTION

80-002319 Brush, E. J.; M. Kalinowski and T. L. Miller. HEAVY METALS IN A STRETCH OF THE SUSQUEHANNA RIVER BADLY POLLUTED WITH ACID MINE EFFLUENTS. *Proc. Pa. Acad. Sci.* 53(2):179-188. 1979. SFA 25(3)
[Dep. Chem., King's Coll., Wilkes-Barre, PA 18711]

80-002320 Burton, D. T.; S. L. Margrey and L. W. Hall, Jr. SEASONAL EFFECTS OF ONCE-THROUGH POWER PLANT CHLORINATION ON SEVERAL ESTUARINE MACROINVERTEBRATES. *ABS (Assoc. Southeast. Biol.) Bull.* 27(2):26. Apr. 1980. SFA 25(3)
[Benedict Estuarine Lab., Benedict, MD]

80-002321 Eisenberg, M.; R. Mallman; and H. S. Tubiash. POLYCHLORINATED BIPHENYLS IN FISH AND SHELLFISH OF THE CHESAPEAKE BAY. *Mar. Fish. Rev.* 42(2):21-25. Feb. 1980. SFA 25(3)
[Environ. Health Admin., Md. Dep. Health Mental Hygiene, Baltimore 21201]

80-002322 Euston, E. T. and D. Mathur. EFFECTS OF HEATED DISCHARGES ON THE WINTER FISHERY IN CONOWINGO POND, PENNSYLVANIA. *Proc. Pa. Acad. Sci.* 53(2):156-160. 1979. SFA 25(3)
[Radiation Management Corp., Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518] A combination of non-uniform probability and random method was used to survey the winter (December-March) fishery in Conowingo Pond, a 3,644-hectare impoundment on the lower Susquehanna River, Pennsylvania, in 1973 through 1977 in reference to the heated discharge from Peach Bottom Atomic Power Station. Most winter fishing occurred from shore or through the ice and was for white crappie, *Pomoxis annularis* (91% of the catch). Winter harvest of white crappie ranged from 4000 to 16000 kg. Differences in catch per effort (2.74 vs 1.39) between the preoperational (1973-1974) and postoperational (1975-1977) periods were attributable to wide variations in year class strength and recruitment. Due to lack of access little winter angling was observed in the thermal plume. The heated discharge did not affect the established winter fishery for white crappie in coves and creek mouths which is dependent upon the downstream movement of crappie in late fall. However, the fishing season may be extended in

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80-002322 CONTINUED the autumn and begin earlier in the spring as a result of the attraction of other game fishes to the heated discharge.

80-002323 Kearns, P. K.; G. J. Atchison and R. J. Vetter. IMPACT OF HEAVY METALS ON THE GROWTH OF YELLOW PERCH (*PERCA FLAVESCENS*) AS MEASURED BY RNA-DNA RATIOS. *Proc. Indiana Acad. Sci.* 88:161-162. 1979. Abstract only. SFA 25(3)

[Biolnucleon. Dep., Purdue Univ., West Lafayette, IN 47907] Yellow perch (*Perca flavescens*) collected from industrially contaminated Palestine Lake were analyzed for cadmium and zinc content by atomic absorption spectrophotometry. Ribonucleic acid-phosphorus, deoxyribonucleic acid-phosphorus content of fish and RNA-DNA ratios were determined in an effort to compare growth of fish from the contaminated area of the lake to the growth of fish from the uncontaminated area of the lake. Of three sampling dates, one revealed significant differences in growth of fish as monitored by length and weight measurements, condition and RNA-DNA ratios between sites. Linear regression analysis of length and weight relationship of fish from the two sites indicated that fish from the uncontaminated area have heavier weights to a given length than fish from the contaminated area of the lake. As body burdens of cadmium increased in yellow perch, condition and RNA-DNA ratio values decreased. Whole body concentrations of zinc had no relationship to condition or RNA-DNA ratios.

80-002324 Leistritz, F. L. and T. A. Hertsgaard. ENVIRONMENTAL, ECONOMIC & SOCIAL IMPACTS OF A COAL GASIFICATION PLANT IN WESTERN NORTH DAKOTA. *N. Dak. Agric. Exp. Stn. Bull.* No. 509. xii + 160p. Feb. 1980. SFA 25(3)

[N. Dak. State Univ., Fargo]

80-002325 Leung, S.-Y. T. THE EFFECT OF IMPOUNDING A RIVER ON THE PESTICIDE CONCENTRATION IN WARMWATER FISH. *Ph.D. dissertation, Iowa State Univ.* 164p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5129. May 1980. SFA 25(3)

Atrazine, alachlor, and bladex concentrations fluctuated seasonally in the dissolved fraction of the Des Moines River water from September, 1977 through November, 1978. These herbicides were not detected in the bottom sediment collected within Saylorville Reservoir and in seven species of fish sampled above, within, and below the reservoir. The herbicides did not accumulate within the reservoir. Organochlorine insecticides dieldrin, heptachlor expoxide, pp'-DDT, pp'-DDE, and pp'-DDD were detected in most fish samples and bottom sediment. Only dieldrin and pp'-DDE were found in both dissolved and suspended fractions of the river water. No discernible insecticide residue pattern was found in the water and fish in regard to time or the year. Classical biomagnification and spatial trend in concentration of insecticides were not noticeable in the fish. However, buildup of organochlorine insecticides within the reservoir has undoubtedly occurred.

80-002326 Lynch, J. A. and E. S. Corbett. ACID PRECIPITATION--A THREAT TO AQUATIC ECOSYSTEMS. *Fisheries (Bull. Am. Fish. Soc.)* 5(3):8-10, 12. May-June 1980. SFA 25(3)

[Pa. State Univ., University Park]

80-002327 Masnik, M. T. and J. H. Wilson. ASSESSMENT OF THE IMPACTS OF THE SALEM AND HOPE CREEK STATIONS ON SHORTNOSE STURGEON, *ACIPENSER BREVIROSTRUM* LESUEUR. *U.S. Nucl. Regul. Environ. Spec. Tech. Rep.* NUREG-0671. xi + 101p. Apr. 1980. SFA 25(3)

[U.S. Nucl. Regul. Comm., Environ. Spec. Br., P-234, Washington, DC 20555] *Acipenser brevirostrum* LeSueur, a federally recognized endangered

POLLUTION (CONTINUED)

80-002327 CONTINUED species, is known from the Delaware River in the vicinity of the Salem and Hope Creek Nuclear Stations. The potential for adverse impact to this species due to the completion of construction and the operation of these stations is assessed. A review of the literature pertaining to the distribution, life history, and tolerance of this species is presented. Both historical records and current status of the shortnose sturgeon population in the Delaware River are discussed. Station systems which could potentially interact with the shortnose sturgeon population are described. An assessment of loss to the population by each system is presented. Based upon the known life history of the species, the operating characteristics of the stations, and the status of the shortnose sturgeon population in the Delaware River, it is concluded that the construction and operation of the Salem and Hope Creek Nuclear Stations will not jeopardize the continued existence of the shortnose sturgeon.

80-002328 Mathur, D.; T. W. Robbins and E. J. Purdy, Jr. ASSESSMENT OF THERMAL DISCHARGES ON ZOOPLANKTON IN CONOWINGO POND, PENNESYLVANIA. *Can. J. Fish. Aquatic Sci.* 37(6):937-944. June 1980. In English with French summ. SFA 25(3)

[Radiation Management Corp., P.O. Box 10, Drumore, PA 17518]

80-002329 Matthews, R. A. SEWAGE EFFECTS IN A SMALL STREAM. *Va. J. Sci.* 30(2):76. 1979. Abstract only. SFA 25(3)

[Cent. Environ. Stud., VPI&SU, Blacksburg, VA 24061] During the winter and early spring of 1978 a study was conducted to evaluate the impact of sewage effluent upon a small stream in southern Indiana. We found the stream to be moderately impacted, sewage effluent representing close to ten percent of the total discharge downstream from the treatment plant outfall. Turbidity, conductivity, ammonia, and soluble reactive phosphorus concentrations increased below the outfall. Dissolved oxygen concentrations demonstrated a typical oxygen sag with recovery. Fish, benthic, and algal diversities were significantly reduced at the site of effluent input; however, both fish and invertebrates recovered downstream.

80-002330 Peňáz, M. FISH CULTURES IN THE AREA OF THE NUCLEAR POWER STATION DUKOVANY AND THEIR PROSPECTS. *Folia Zool.* 29(1):87-96. 1980. In English with Russian summ. SFA 25(3)

[Inst. Vert. Zool., Czechoslovak Acad. Sci., Brno, Czechoslovakia]

80-002331 Phillips, G. R.; T. E. Lenhart and R. W. Gregory. RELATION BETWEEN TROPHIC POSITION AND MERCURY ACCUMULATION AMONG FISHES FROM THE TONGUE RIVER RESERVOIR, MONTANA. *Environ. Res.* 22(1):73-80. June 1980. SFA 25(3)

[Mont. Coop. Fish Res. Unit, Mont. State Univ., Bozeman 59717] Concentrations of total mercury were determined in muscle tissue from northern pike (*Esox lucius*), sauger (*Stizostedion canadense*), walleye (*S. vitreum*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*P. annularis*) collected from the Tongue River Reservoir, Montana, prior to extensive surface coal-mine development in the region. Mercury concentrations in fish flesh increased with fish size and age; larger individuals of all five species exceeded the U.S. Food and Drug Administration's mercury concentration guideline of 0.5 µg/g. The rate of mercury accumulation was faster in the piscivorous species (northern pike, saugers, and walleyes) than in the planktivores (black crappies and white crappies). Differences in mercury uptake rates among the various species appeared to be directly related to the quantity of mercury eaten; results are discussed in relation to published models of mercury accumulation by fishes.

POLLUTION (CONTINUED)

80-002332 Phillips, G. R. and R. W. Gregory. ACCUMULATION OF SELECTED ELEMENTS (AS, CU, HG, PB, SE, ZN) BY NORTHERN PIKE (*ESOX LUCIUS*) REARED IN SURFACE COAL MINE DECANT WATER. *Proc. Mont. Acad. Sci.* 39:44-50. 1980. SFA 25(3)

[Coop. Fish. Res. Unit, Mont. State Univ., Bozeman 59717] The average mercury concentration in northern pike (*Esox lucius*) reared in decant water from a surface coal mine at West Decker, Montana, increased from 0.00 to 0.13 µg Hg/g wet tissue from 5 May to 7 October, 1977. This rate of mercury uptake is only slightly faster than that experienced by northern pike in the Tongue River Reservoir. Pike reared in mine water did not accumulate arsenic, copper, lead, selenium, or zinc. We conclude that coal mining at West Decker is not currently causing the dissolution of harmful concentrations of these elements and that the high concentrations of mercury present in adult northern pike from the Tongue River Reservoir are not attributable to coal mining activity.

80-002333 Plaskett, D. and I. C. Potter. HEAVY METAL CONCENTRATIONS IN THE MUSCLE TISSUE OF 12 SPECIES OF TELEOST FROM COCKBURN SOUND, WESTERN AUSTRALIA. *Aust. J. Mar. Freshwater Res.* 30(5):607-616. Oct. 1979. SFA 25(3)

[Sch. Environ. Life Sci., Murdoch Univ., Murdoch, Western Australia 6153, Australia]

80-002334 Rogers, L.; J. Yopp and E. E. Cook. INDICATED TRENDS OF MERCURY IN AQUATIC AND TERRESTRIAL FOOD CHAINS IN ILLINOIS. *Trans. Ill. State Acad. Sci.* 72(2):56-63. 1979. SFA 25(3)

[Dep. Technol., South. Ill. Univ., Carbondale 62901] Sources of mercury in the State of Illinois, including industrial, municipal, and institutional wastes, consumption of fossil fuels, and natural sources are examined. Historical records of the Illinois Environmental Protection Agency are reviewed for trends of mercury concentrations in Illinois' waters and sediments and for evidence of mercury accumulation in constituent organisms of terrestrial and aquatic food chains. There appears to be no evidence at this time of serious or widespread mercury contamination in Illinois.

80-002335 Ryan, P. M. and H. H. Harvey. GROWTH RESPONSES OF YELLOW PERCH, *PERCA FLAVESCENS* (MITCHILL), TO LAKE ACIDIFICATION IN THE LA CLOCHE MOUNTAIN LAKES OF ONTARIO. *Environ. Biol. Fishes* 5(2):97-108. 22 Apr. 1980. SFA 25(3)

[Dep. Fish Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-002336 Schumacher, P. D. and J. J. Hey. AVOIDANCE RESPONSE OF RAINBOW TROUT (*SALMO GAIRDNERI*) TO SINGLE-DOSE CHLORINATION IN A POWER PLANT DISCHARGE CANAL. *Water Res.* 14(6):651-655. 1980. SFA 25(3)

[Environ. Dep., Wis. Elec. Power Co., Milwaukee 53201] Rainbow trout (*Salmo gairdneri*) were exposed to 20 min single-dose chlorine additions designed to achieve maximum total residual chlorine (TRC) concentrations of 0.04, 0.2, 0.6, and 1.0 mg/l. First retreats from the chlorine front occurred at 0.05 TRC. Approximately 95% of the fish had moved downstream when TRC reached 0.5 mg/l, well before cumulative time-dose exposure approached lethal limits. Percentage of fish remaining near the discharge decreased linearly as TRC concentration rose, suggesting that a rapid rise in receiving water chlorine level might be beneficial in reducing cumulative time-dose exposure. Rainbow trout demonstrated the initial sensitivity to avoid lethal chlorine exposure, but complete assessment of the utility of the avoidance response must also consider distribution throughout chlorination and the potential for repeated exposure.

POLLUTION (CONTINUED)

80-002337 Sorentino, C. MERCURY IN MARINE AND FRESHWATER FISH OF PAPUA NEW GUINEA. *Aust. J. Mar. Freshwater Res.* 30(5):617-623. Oct. 1979. SFA 25(3)
[Ranger Uranium Mines Pty. Ltd., P.O. Box 693, Chatswood, New South Wales 2067, Australia]

80-002338 Vinikour, W. S.; R. M. Goldstein and R. V. Anderson. BIOCONCENTRATION PATTERNS OF ZINC, COPPER, CADMIUM AND LEAD IN SELECTED FISH SPECIES FROM THE FOX RIVER, ILLINOIS. *Bull. Environ. Contam. Toxicol.* 24(5):727-734. May 1980. SFA 25(3)
[Environ. Impact Stud. Div., Argonne Natl. Lab., Argonne, IL 60439]

FISH KILLS

80-002339 Johnston, C. E. and J. C. Cheverie. REPOPULATION OF A COASTAL STREAM BY BROOK TROUT AND RAINBOW TROUT AFTER ENDOSULFAN POISONING. *Prog. Fish Cult.* 42(2):107-110. Apr. 1980. SFA 25(3)
[Dep. Biol., Univ. Prince Edward Island, Charlottetown, PE C1A 4P3, Canada]

TOXICOLOGY; BIOASSAYS

80-002340 Arunachalam, S.; K. Jeyalakshmi and S. Aboobucker. TOXIC AND SUBLETHAL EFFECTS OF CARBARYL ON A FRESHWATER CATFISH, *MYSTUS VITTATUS* (BLOCH). *Arch. Environ. Contam. Toxicol.* 9(3):307-316. 1980. SFA 25(3)
[Dep. Zool., Manonmaniam Sundaranar Univ., P.G. Cent., Arulmigu Palaniandavar Arts Coll., PALNI 624602, Tamil Nadu, India] The effects of carbaryl (1-naphthalenyl methylcarbamate), commonly used in agricultural operations, have been studied with reference to survival, behavior, food intake, growth, and conversion efficiency of the catfish *Mystus vittatus*. At a concentration of 32.5 ppm, carbaryl caused 100% mortality within 24 hr; the 72 hr LC_{50} was 17.5 ppm. At concentrations of 12.5 ppm and below, it caused no mortalities within 72 hr. But such sublethal concentrations accelerated the swimming activity and increased the frequency of opercular beats. The latter response was dose-dependent. These behavioral changes were the immediate response to the toxicant and were indicators of possible stress. A 27-day exposure to sublethal concentrations of carbaryl led to a decrease in feeding rate and growth rate. The latter decreased from 10.15 mg/g/day (freshwater) to 2.84 mg/g/day (12.5 ppm). The reduced growth and conversion efficiency may be due to the expenditure of more energy for the purpose of maintenance. Therefore, the insecticide is considered to be a metabolic stressor.

80-002341 Ashcom, T. L. SERUM CORTISOL AND ELECTROLYTE RESPONSES IN ACID-STRESSED BROOK TROUT (*SALVELINUS FONTINALIS*). *Ph.D. dissertation, Pa. State Univ.* 141p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5150. May 1980. SFA 25(3)

80-002342 Bagnis, R.; S. Chanteau; E. Chungue; J. M. Hurtel; T. Yasumoto and A. Inoue. ORIGINS OF CIGUATERA FISH POISONING: A NEW DINOFLAGELLATE, *GAMBIERDISCUS TOXICUS* ADACHI AND FUKUYO, DEFINITIVELY INVOLVED AS A CAUSAL AGENT. *Toxicon* 18(3):199-208. 1980. SFA 25(3)
[Med. Oceanogr. Univ., Louis Malardé Med. Res. Inst., P.O. Box 30, Papeete Tahiti, French Polynesia]

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002343 Bengtsson, B.-E. LONG-TERM EFFECTS OF PCB (CLOPHEN A50) ON GROWTH, REPRODUCTION AND SWIMMING PERFORMANCE IN THE MINNOW, *PHOXINUS PHOXINUS*. *Water Res.* 14(6):681-687. 1980. SFA 25(3)
[Natl. Environ. Prot. Bd., Brackish Water Toxicol. Lab., Studsvik, S-611 82 Nyköping, Sweden] Adult minnows, *Phoxinus phoxinus*, were orally dosed with PCB (Clophen A50) for 40 days and were studied for 300 days for long-term sublethal effects. Clophen A50 was found to have a growth promoting effect and demonstrated several effects on reproduction. Swimming performance, studied by the rotatory-flow technique, was not affected at the concentrations that gave effects on growth and reproduction. The clearance of accumulated PCB from the body was slow.

80-002344 Colquhoun, J. E. and H. J. Dean. TOXICITY OF PROPOXUR TO BROOK TROUT AND LANDLOCKED SALMON. *N.Y. Fish Game J.* 27(1):32-38. Jan. 1980. SFA 25(3)
[407 53rd St., Rome, NY 13440] Static bioassay tests of propoxur were conducted using brook trout and landlocked salmon fingerlings to produce estimates of acute toxicity. For brook trout, the 24-hour EC_{50} was estimated to be 3.0 milligrams per liter, and the 24-hour LC_{50} was estimated to be 6.0 milligrams per liter. The 24-hour LC_{50} for landlocked salmon was estimated to be 11.2 milligrams per liter. It is considered highly unlikely that normal application rates would produce such concentrations, and direct mortality of these species as a result of such applications would probably not occur.

80-002345 Davenport, J.; S. Lønning and L. J. Sæthre. THE EFFECTS OF EKOFISK OIL EXTRACT UPON OXYGEN UPTAKE IN EGGS AND LARVAE OF THE COD *GADUS MORHUA* L. *Astarte* 12(1):31-34. 1979. SFA 25(3)
[N.E.R.C. Unit Mar. Invert. Biol., Mar. Sci. Lab., Menai Bridge, Gwynedd, Wales] Ekofisk oil extract (8ppm total hydrocarbons dissolved and dispersed oil) had no significant effect upon oxygen uptake in late stage cod embryos and larvae with functional yolk sacs. However, early embryos and starved larvae showed a reduction in oxygen consumption when placed in the extract; it was also noted that starved larvae became narcotised. Despite these results, doubt is expressed concerning the usefulness of oxygen consumption measurements in elucidating subtle sublethal effects of pollutants.

80-002346 Daye, P. G. ATTEMPTS TO ACCLIMATE EMBRYOS AND ALEVINS OF ATLANTIC SALMON, *SALMO SALAR*, AND RAINBOW TROUT, *S. GAIRDNERI*, TO LOW pH. *Can. J. Fish. Aquatic Sci.* 37(6):1035-1038. June 1980. In English with French summ. SFA 25(3)
[Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

80-002347 Edgren, M. and R. Notter. CADMIUM UPTAKE BY FINGERLINGS OF PERCH (*PERCA FLUVIATILIS*) STUDIED BY Cd-115M AT TWO DIFFERENT TEMPERATURES. *Bull. Environ. Contam. Toxicol.* 24(5):647-651. May 1980. SFA 25(3)
[Natl. Swed. Environ. Prot. Bd., S-170 11 Drottningholm, Sweden]

80-002348 Elmore, M. B.; T. L. Beitinger and D. W. Huey. TOXICITY OF PULSED MONOCHLORAMINES TO GOLDFISH (*CARASSIUS AURATUS*). *Bull. Environ. Contam. Toxicol.* 24(5):692-695. May 1980. SFA 25(3)
[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

TOXICOLOGY: BIOASSAYS (CONTINUED)

80-002349 Finlayson, B. J. and K. M. Verrue. ESTIMATED SAFE ZINC AND COPPER LEVELS FOR CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*, IN THE UPPER SACRAMENTO RIVER, CALIFORNIA. *Calif. Fish Game* 66(2):68-82. Apr. 1980. SFA 25(3)

[Calif. Dep. Fish Game, Water Pollut. Control Lab., 2005 Nimbus Rd., Rancho Cordova 95670] Long-term (83-d) and short-term (96-h) toxicity tests with combined copper and zinc solutions were conducted on chinook salmon, *Oncorhynchus tshawytscha*, eggs, alevins, and swim-up fry to determine tolerance levels to copper and zinc in the acid-mine waste from Spring Creek, a tributary to the Sacramento River. The ratio of copper-to-zinc in the waste can vary between 1:2 and 1:12. Eggs were just as tolerant or more tolerant than alevins and fry to combined concentrations of copper and zinc. The 83-d LC50 values (median lethal) for the period of eggs-to-fry to 1:3, 1:6, and 1:11 copper-to-zinc ratio stock solutions were 44 µg/l Cu and 160 µg/l Zn, 27 µg/l Cu and 206 µg/l Zn, and 17 µg/l Cu and 253 µg/l Zn, respectively, demonstrating that the toxicities of copper and zinc were "additive". The 96-h LC50 values for fry not previously exposed to the stock solutions were 37 µg/l Cu and 132 µg/l Zn, 29µg/l Cu and 213 µg/l Zn, and 20 µg/l Cu and 279 µg/l Zn, for the same copper-to-zinc ratio stock solutions, respectively, demonstrating that an acclimation to these metals had occurred in the 83-d tests during embryonic and alevin development at the higher (1:3) copper-to-zinc ratio but not at the lower (1:6 and 1:11) copper-to-zinc ratios. Based on reduced growth of exposed fry for the period of eggs-to-fry, estimated "safe" levels of copper and zinc for chinook salmon would be below 11 and 83 µg/l, respectively.

80-002350 Garofano, J. S. THE EFFECTS OF CADMIUM ON THE PERIPHERAL BLOOD AND HEAD KIDNEY OF THE BROWN BULLHEAD *ICTALURUS NEBULOSUS* (LESUEUR). *Ph.D. dissertation, N.Y. Univ.* 134p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5109. May 1980. SFA 25(3)

The results of the present study suggest that acute exposure of fish to cadmium increases the cadmium accumulation in the fish. The rate of accumulation was different for the blood as compared to that in the head kidney which accumulates cadmium at significantly high levels for up to two months following the intial exposure. It seems that the physiologic mechanism governing the proliferative regulatory mechanism in the fish is similar to those of mammalian vertebrates. Although the feedback mechanism may be modified in lower vertebrates, nonetheless the present investigation confirms that some undifferentiated stem cell must have been triggered to become all of the cells that would eventually be delivered to the peripheral circulation.--From abstr.

80-002351 Graves, W. C.; D. T. Burton, L. B. Richardson and S. L. Margrey. SURVIVAL OF SHEEPSHEAD MINNOW (*CYPRINODON VARIEGATUS*) EMBRYOS, FRY, JUVENILES AND ADULTS EXPOSED TO TREATED BLEACHED KRAFT MILL EFFLUENT AT VARIOUS DISSOLVED OXYGEN LEVELS. *ABS (Assoc. Southeast. Biol.) Bull.* 27(2):37. Apr. 1980. SFA 25(3)

[Benedict Estuarine Lab., Benedict, MD] The interaction of dissolved oxygen (DO) concentration and treated bleached kraft mill effluent (BKME) on the survival of embryo, fry, juvenile and adult developmental stages of the sheepshead minnow (*Cyprinodon variegatus*) was investigated by using a 3 X 3 complete matrix design with two replicates per cell. Each life stage was exposed under continuous-flow conditions to effluent concentrations of 0, 50% and 100% (l/vv) and nominal DO concentrations of 1.0, 3.0 and 5.0 mg/l. Mortality observations at the end of 96 h were used for statistical analyses. The percent of embryo hatching success was solely related to effluent concentration. Survival of the fry was related to effluent concentration. Juvenile fish showed increased sensitivity to BKME at a nominal DO concentration of 1.0 mg/l. Adult fish were not affected by BKME at any of the DO concentrations tested. This study shows that a systematic investigation must be made on each life stage of a test organism in order to fully evaluate any potential interactions of treated BKME and low DO interactions of treated BKME and low DO concentrations.

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002352 Guiney, P. D.; J. J. Lech and R. E. Peterson. DISTRIBUTION AND ELIMINATION OF A POLYCHLORINATED BIPHENYL DURING EARLY LIFE STAGES OF RAINBOW TROUT (*SALMO GAIRDNERI*). *Toxicol. Appl. Pharmacol.* 53(3):521-529. May 1980. SFA 25(3)
[Sch. Pharm., Univ. Wis., Madison 53706]

80-002353 Hawkins, W. E.; L. G. Tate and T. G. Sarphie. ACUTE EFFECTS OF CADMIUM ON THE SPOT *LEIOSTOMUS XANTHURUS* (TELEOSTEI): TISSUE DISTRIBUTION AND RENAL ULTRASTRUCTURE. *J. Toxicol. Environ. Health* 6(2):283-295. Mar. 1980. SFA 25(3)
[Dep. Anat. Biol., Univ. South Ala., Mobile]

80-002354 Hedtke, S. F. and F. A. Puglisi. EFFECTS OF WASTE OIL ON THE SURVIVAL AND REPRODUCTION OF THE AMERICAN FLAGFISH, *JORDANELLA FLORIDAE*.
[U.S. EPA, Newtown Fish Toxicol. Stn., 3411 Church St., Cincinnati, OH 45244]

80-002355 Helder, T. EFFECTS OF 2,3,7,8-TETRACHLORODIBENZO-*p*-DIOXIN (TCDD) ON EARLY LIFE STAGES OF THE PIKE (*ESOX LUCIUS* L.). *Sci. Total Environ.* 14(3):255-264. Apr. 1980. SFA 25(3)
[Dep. Spec. Anim. Pathol., Univ. Utrecht, Biltstr. 172, Utrecht, The Netherlands] Freshly fertilized pike eggs were exposed to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) at concentrations of 0.1, 1.0 and 10 ppt (ng/liter) for 96 hours. At all concentrations examined egg development was retarded by 23%, and the growth of fry was also significantly retarded for a long period after exposure. A dose-related mortality was observed. Highest mortality rates occurred during resorption of the yolk and reached almost 100 percent at a concentration of 10 ppt. Death was preceded by development of severe generalized edemas. Histopathologically edemas and hemorrhages were observed, together with alterations of bloodvessel walls. In the liver, two stages of pathological changes were distinguished. The first was characterized by a dilation of sinusoids and a slight swelling of hepatocyte nuclei; in the second stage the nuclei were enlarged up to twice the normal diameter. Hepatocytes were degenerated and varied in size and shape and liver architecture was almost completely lost.

80-002356 Herzberg, A.; A. Gelman and A. S. Perry. THE LOCATION OF LINDANE (GAMMA-HEXACHLOROCYCLOHEXANE) IN FISH AFTER DELIBERATE POISONING. *Bamidgeh* 32(1):16-19. Mar. 1980. SFA 25(3)
[Minist. Agric., Dep. Fish., Fish. Technol. Unit, P.O.B. 699, Haifa 31000, Israel]

80-002357 Hodson, P. V.; D. J. Spry and B. R. Blunt. EFFECTS ON RAINBOW TROUT (*SALMO GAIRDNERI*) OF A CHRONIC EXPOSURE TO WATERBORNE SELENIUM. *Can. J. Fish. Aquatic Sci.* 37(2):233-240. Feb. 1980. In English with French summ. SFA 25(3)
[Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

80-002358 Hodson, P. V.; J. W. Hilton; B. R. Blunt and S. J. Slinger. EFFECTS OF DIETARY ASCORBIC ACID ON CHRONIC LEAD TOXICITY TO YOUNG RAINBOW TROUT (*SALMO GAIRDNERI*). *Can. J. Fish. Aquatic Sci.* 37(2):170-176. Feb. 1980. In English with French summ. SFA 25(3)
[Dep. Fish Oceans, Great Lakes Biolimnol. Lab., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002359 Hollister, T. A.; G. S. Ward and P. R. Parrish. ACUTE TOXICITY OF A #6 FUEL OIL TO MARINE ORGANISMS. *Bull. Environ. Contam. Toxicol.* 24(5):656-661. May 1980. SFA 25(3)
[EG&G, Bionomics, Mar. Res. Lab., Rt. 6, Box 1002, Pensacola, FL 32507]

80-002360 James, M. O. and J. R. Bend. POLYCYCLIC AROMATIC HYDROCARBON INDUCTION OF CYTOCHROME *P*-450-DEPENDENT MIXED-FUNCTION OXIDASES IN MARINE FISH. *Toxicol. Appl. Pharmacol.* 54(1):117-133. 15 June 1980. SFA 25(3)
[N.I.E.H.S. Lab., c/o C.V. Whitney Lab. Exp. Mar. Biol. Med., RFD 1, Box 121, St. Augustine, FL 32084]

80-002361 Kaiser, K. L. E. CORRELATION AND PREDICTION OF METAL TOXICITY TO AQUATIC BIOTA. *Can. J. Fish. Aquatic Sci.* 37(2):211-218. Feb. 1980. In English with French summ. SFA 25(3)
[Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

80-002362 Kobayashi, K. and T. Kishino. EFFECT OF pH ON THE TOXICITY AND ACCUMULATION OF PENTACHLOROPHENOL IN GOLDFISH. *Bull. Jpn. Soc. Sci. Fish.* 46(2):167-170. Feb. 1980. SFA 25(3)
[Lab. Fish. Environ. Sci., Fac. Agric., Kyushu Univ., Fukuoka 812, Japan]

80-002363 Koschier, F. J. and J. B. Pritchard. RENAL HANDLING OF 2,4-D BY THE DOGFISH SHARK (*SQUALUS ACANTHIAS*). *Xenobiotica* 10(1):1-6. Jan. 1980. SFA 25(3)
[Food Drug Res. Lab., P.O. Box 107, Waverly, NY 14892]

80-002364 Kruzynski, G. M. SOME EFFECTS OF DEHYDROABIETIC ACID (DHA) ON HYDROMINERAL BALANCE AND OTHER PHYSIOLOGICAL PARAMETERS IN JUVENILE SOCKEYE SALMON *ONCORHYNCHUS NERKA*. *Ph.D. dissertation, Univ. British Columbia* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5170. May 1980. SFA 25(3)

80-002365 Leatherland, J. F. and R. A. Sonstegard. EFFECT OF DIETARY MIREX AND PCB'S IN COMBINATION WITH FOOD DEPRIVATION AND TESTOSTERONE ADMINISTRATION ON THYROID ACTIVITY AND BIOACCUMULATION OF ORGANOCHLORINES IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 3(2):115-124. Mar. 1980. SFA 25(3)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-002366 Meade, T. L. and S. J. Perrone. EFFECT OF CHLORIDE ION CONCENTRATION AND pH ON THE TRANSPORT OF NITRITE ACROSS THE GILL EPITHELIA OF COHO SALMON. *Prog. Fish-Cult.* 42(2):71-72. Apr. 1980. SFA 25(3)
[Dep. Anim. Sci., Coll. Resour. Dev., Univ. R.I., Kingston 02881]

80-002367 Melancon, M. J. and J. J. Lech. UPTAKE, METABOLISM, AND ELIMINATION OF ^{14}C-LABELED 1,2,4-TRICHLOROBENZENE IN RAINBOW TROUT AND CARP. *J. Toxicol. Environ. Health* 6(3):645-658. May 1980. SFA 25(3)
[Med. Coll. Wis., P.O. Box 26509, Milwaukee 53226] Fingerling rainbow trout (*Salmo gairdneri*) were exposed to ^{14}C-labeled 1,2,4-trichlorobenzene (TCB) for 8 h in a static exposure (0.018 mg/l) or for 35 d in a continuous-flow exposure (0.020 mg/l) followed by a subsequent elimination period. For the 2 d after the 8-h exposure, the half-time ($t_{1/2}$) of elimination of ^{14}C from muscle and liver was 0.4 d, while after the 35-d exposure an early rapid elimination of ^{14}C from these tissues ($t_{1/2}$ = 0.4 d) was followed by a slower elimination ($t_{1/2}$ = 50 d) during d 4-36. The maximum bioconcentration factors for ^{14}C in

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002367 CONTINUED muscle and liver were 51 and 102 after the 8-h exposure and 89 and 389 during the 35-d exposure. The values for bile were much greater, reaching 240 after the 8-h exposure and 89 and 389 during the 35-d exposure. The values for bile were much greater, reaching 240 after the 8-h exposure and 1400 during the 35-d exposure. When larger trout and carp (*Cyprinus carpio*) were exposed to [^{14}C]TCB(0.2-0.4 mg/l) the bioconcentration factor for bile ^{14}C to water ^{14}C was less than 100. Pretreatment of trout with β-naphthoflavone, an inducer of hepatic mixed-function oxidase, increased this bioconcentration factor for bile to several hundred. Solvent partitioning and thin-layer chromatography (TLC) indicated that about 60% of the ^{14}C in bile of control trout or carp was present as highly polar biotransformation products, while for induced trout the value was more than 90%. TLC in two solvent systems suggested that at least two such products were present in bile from control fish and at least three in bile from induced fish. About half of the ^{14}C in bile from induced trout was more polar than the ^{14}C in bile from normal trout.

80-002368 Middaugh, D. P.; L. E. Burnett and J. A. Couch. TOXICOLOGICAL AND PHYSIOLOGICAL RESPONSES OF THE FISH, *LEIOSTOMUS XANTHURUS*, EXPOSED TO CHLORINE PRODUCED OXIDANTS. *Estuaries* 3(2):132-141. June 1980. SFA 25(3)
[Gulf Breeze Environ. Res. Lab., Bears Bluff Field Stn., Box 368, John's Island, SC 29455] The sublethal and lethal effects of chlorine produced oxidants (CPO) on juveniles of the estuarine teleost, *Leiostomus xanthurus*, were investigated in flowing water tests conducted at 30 ± 1°C and 26 to 31 °/oo salinity. Short-term LT50 tests were conducted at two nominal concentrations of NaOCl, 1.0 and 1.4 mg/l (respective measured CPO concentrations 0.09 and 0.12 mg/l) which were sublethal in 2,880 minute exposures; and three nominal concentrations, 1.6, 1.8 and 3.2 mg/l NaOCl (respective measured CPO concentrations 0.13, 0.20 and 0.37 mg/l) which were acutely toxic. Opercular ventilation rates in exposed spot were much higher than in control fish, but returned to rates only slightly above those of controls during the latter portion of the 2,880 minute exposure to the two sublethal CPO concentrations. Opercular rates at the three acutely toxic CPO concentrations remained much higher than control rates until the exposed fish died. Blood pH after 2,880 minutes of exposure to the sublethal concentrations of CPO, or at the respective estimated LT50 for lethal concentrations, showed significant decreases (mean as low as 6.84) compared to controls (mean 7.35). No significant changes in the % methemoglobin were observed. Oxygen uptake by spot was depressed at all of the measured concentrations of CPO tested. Histopathological examination showed that gill respiratory epithelial tissues sloughed away from the underlying pillar cells. Complete denudation of circulatory tissues and hemangiectic secondary lamellae were observed in gill tissues from fish exposed to the highest CPO concentration of 0.37 mg/l.

80-002369 Panigrahi, A. K. and B. N. Misra. TOXICOLOGICAL EFFECTS OF A SUB-LETHAL CONCENTRATION OF INORGANIC MERCURY ON THE FRESH WATER FISH, *TILAPIA MOSSAMBICA*, PETERS. *Arch. Toxicol.* 44(4):269-278. Apr. 1980. SFA 25(3)
[Lab. Environ. Toxicol., Dep. Bot., Berhampur Univ., 760 007, Berhampur, Orissa, India]

80-002370 Peterson, R. H.; P. G. Daye and J. L. Metcalfe. INHIBITION OF ATLANTIC SALMON (*SALMO SALAR*) HATCHING AT LOW pH. *Can. J. Fish. Aquatic Sci.* 37(5):770-774. May. 1980. In English with French summ. SFA 25(3)
[Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002371 Pickering, Q. H. CHRONIC TOXICITY OF HEXAVALENT CHROMIUM TO THE FATHEAD MINNOW (*PIMEPHALES PROMELAS*). *Arch. Environ. Contam. Toxicol.* 9(4):405-413. 1980. SFA 25(3)

[U.S. EPA, Newtown Fish Toxicol. Stn., Cincinnati, OH 45244] The chronic effects of hexavalent chromium on the fathead minnow (*Pimephales promelas*) were investigated. Survival was affected only at the high test concentration of 3.95 mg Cr/L. All chromium concentrations, including 0.018 mg/L, the lowest tested, retarded the early growth of first-generation fish, but this effect was only temporary. Growth of second-generation fish was not affected at concentrations of 1.0 mg/L or lower. Reproduction and hatchability of eggs were not affected at any chromium concentration tested. The maximum acceptable toxicant concentration (MATC) for fathead minnows in hard water (209 mg/L as $CaCO_3$ at pH 7.7) was based on survival and lies between 1.0 and 3.95 mg Cr/L, respectively. The application factor (MATC/96-hr LC50) is between 0.03 and 0.11.

80-002372 Roales, R. R. and A. Perlmutter. METHYLMERCURY/COPPER EFFECTS ON HEMOSIDERIN: POSSIBLE MECHANISM OF IMMUNE SUPPRESSION IN FISH. *Bull. Environ. Contam. Toxicol.* 24(5):704-710. May 1980. SFA 25(3)

[Div. Biol. Phys. Sci., Indiana Univ., 2300 S. Washington St., Kokomo 46901]

80-002373 Sahib, I. K. A. and K. V. R. Rao. CORRELATION BETWEEN SUBACUTE TOXICITY OF MALATHION AND ACETYLCHLOINESTERASE INHIBITION IN THE TISSUES OF THE TELEOST *TILAPIA MOSSAMBICA*. *Bull. Environ. Contam. Toxicol.* 24(5):711-718. May 1980. SFA 25(3)

[Dep. Zool., S. V. Univ., Tirupati - 517 502, A.P. India]

80-002374 Sargent, J. R.; M. V. Bell; K. F. Kelly; A. Johnstone; A. Hawkins and C. D. Hall. SODIUM ORTHOVANADATE AND CARDIAC ACTIVITY IN TELEOST FISH. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 66(1):111-114. 1980. SFA 25(3)

[N.E.R.C. Inst. Mar. Biochem., Aberdeen, Scotland] The electrocardiogram was monitored in decerebrate cod and trout after intravenous injection of sodium orthovanadate. Slowing of the heart rate occurred 1 min after injecting 84 µg of Na_3VO_4 (equivalent to 23µg elemental V). Heart beat was apparently suppressed for up to 30 min after injecting 168 µg of Na_3VO_4 and then returned to normal. Significant changes in heart rate and gill ventilation rate did not occur in fish exposed to $1/10^4$ M orthovanadate in the external medium for up to 6 days. Results are discussed in terms of possible toxicity of environmental vanadium to aquatic species.

80-002375 Sastry, K. V. and K. Sharma. EFFECTS OF MERCURIC CHLORIDE ON THE ACTIVITIES OF BRAIN ENZYMES IN A FRESH WATER TELEOST, *OPHIOCEPHALUS (CHANNA) PUNCTATUS*. *Arch. Environ. Contam. Toxicol.* 9(4):425-430. 1980. SFA 25(3)

[Sch. Environ. Contam. Toxicol., Dep. Zool., D.A.V. (P.G.) Coll., Muzaffarnagar-251001, India] The effects of an acute lethal (1.8 mg/L) and a sublethal concentration (0.3 mg/L) of mercuric chloride on the activities of alkaline phosphatase, acid phosphatase, glucose-6-phosphatase, Na^+, K^+ adenosine triphosphatase, succinic dehydrogenase, lactic dehydrogenase, pyruvic dehydrogenase and chloinesterase in the brain of a fresh water fish, *Ophiocephalus (Channa) punctatus* were determined. Exposures were for 4, 15 or 30 days. Acute exposure to mercuric chloride inhibited alkaline phosphatase activity while chronic treatment increased the activity. Acid phosphatase and Na^+, K^+ adenosine triphosphatase activities were elevated after four days, but chronic exposure inhibited

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002375 CONTINUED their activites. The activities of glucose-6-phosphatase, succinic dehydrogenase, lactic dehydrogenase, pyruvic dehydrogenase, and cholinesterase were inhibited by both acute and chronic treatments. Maximum inhibitions occurred after four days with alkaline phosphatase and cholinesterase, 15 days with acid phosphatase and 30 days with glucose-6-phosphatase, Na^+, K^+ adenosine triphosphatase, and the three dehydrogenases.

80-002376 Schnell, J. V.; E. H. Gruger, Jr. and D. C. Malins. MONO-OXYGENASE ACTIVITIES OF COHO SALMON (*ONCORHYNCHUS KISUTCH*) LIVER MICROSOMES USING THREE POLYCYCLIC AROMATIC HYDROCARBON SUBSTRATES. *Xenobiotica* 10(3):229-234. Mar. 1980. SFA 25(3)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Benzo[a]pyrene, 2,6-dimethylnaphthalene, and naphthalene were used as substrates for a coho salmon (*Oncorhynchus kisutch*) liver microsomal preparation. The apparent Michaelis constants (K_m) were as follows: benzo[a]pyrene, 2.1 μM; 2,6-dimethylnaphthalene, 15.3 μM; and naphthalene, 300 μM. The results indicate that the microsomal preparation had a high affinity for 2,6-dimethylnaphthalene. Thus, 2,6-dimethylnaphthalene, an important consitiuent of petroleum products, is a useful substrate for research on the disposition *in vivo* and *in vitro* of xenobiotics introduced into marine environments by petroleum pollution.

80-002377 Sharp, J. R. THE EFFECTS OF MERCURIC CHLORIDE AND METHYLMERCURIC CHLORIDE ON THE DEVELOPMENTAL BIOLOGY OF THE ESTUARINE TELOEST *FUNDULUS HETEROCLITUS* (WALBAUM). *Ph.D. dissertation, Tex. A&M Univ.* 242p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5512. June 1980. SFA 25(3)

80-002378 Singh, H. and T. P. Singh. EFFECT OF TWO PESTICIDES ON OVARIAN P UPTAKE AND GONADOTROPHIN CONCENTRATION DURING DIFFERENT PHASES OF ANNUAL REPRODUCTIVE CYCLE IN THE FRESHWATER CATFISH, *HETEROPNEUSTES FOSSILIS* (BLOCH). *Environ. Res.* 22(1):190-200. June 1980. SFA 25(3)
[Dep. Zool., Fish Endocrinol. Lab., Banaras Hindu Univ., Varanasi-221005, India]

80-002379 Singh, H. and T. P. Singh. THYROID ACTIVITY AND TSH POTENCY OF THE PITUITARY GLAND AND BLOOD SERUM IN RESPONSE TO CYTHION AND HEXADRIN TREATMENT IN THE FRESHWATER CATFISH, *HETEROPNEUSTES FOSSILIS* (BLOCH). *Environ. Res.* 22(1):184-189. June 1980. SFA 25(3)
[Dep. Zool., Fish Endocrinol. Lab., Banaras Hindu Univ., Varanasi-221005, India]

80-002380 Takaku, T.; M. Takahashi and A. Otsuki. [DISPERSION OF AN ORGANOPHOSPHORUS INSECTICIDE, FENITROTHION, IN PADDY FIELDS AND ITS EFFECTS ON THE MICROORGANISMS. *Jpn. J. Limnol.* 40(3):137-144. July 1979. In Japanese with English summ. SFA 25(3)
[Grad. Sch. Environ. Sci., Univ. Tsukuba, Sakura-mura, Ibaraki, 305 Japan]

80-002381 Verma, S. R.; S. Rani and R. C. Dalela. EFFECTS OF PHENOL AND DINITROPHENOL ON ACID AND ALKALINE PHOSPHATASES IN TISSUES OF A FISH (*NOTOPTERUS NOTOPTERUS*). *Arch. Environ. Contam. Toxicol.* 9(4):451-459. 1980. SFA 25(3)
[Pollut. Relevant Res. Lab., P.B. 264, Post-grad. Dep. Zool., D.A.V. Coll., Muzaffarngar-251001, India] Specimens of a fresh water fish, *Notopterus notopterus* were exposed to either phenol (12.56 mg/L), dinitrophenol (1.34 mg/L), or a mixture of the two (6.28 mg phenol + 0.67 mg dinitrophenol/L) for 72-hr. Surviving fish were sacrificed at 24-, 48-, and

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002381 CONTINUED 72-hr after exposure, and tissue samples were taken for determining the acid phosphatase and alkaline phosphatase activities. Phenol, dinitrophenol, and mixtures of both, inhibited the activity of both enzymes in the kidney, heart, brain, gills, muscles, stomach, intestine, and pyloric caeca. Dinitrophenol exerted more inhibition than phenol. In general, mixtures of phenol and dinitrophenol are somewhat more effective than either compound alone in the inhibition of enzyme activities.

80-002382 Watson, T. A. and F. W. H. Beamish. EFFECTS OF ZINC ON BRANCHIAL ATPase ACTIVITY *IN VIVO* IN RAINBOW TROUT, *SALMO GAIRDNERI*. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 66(1):77-82. 1980. SFA 25(3)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

FISH TOXICANTS

80-002383 Niblett, P. D. and B. A. McKeown. EFFECT OF THE LAMPREY LARVICIDE TFM (3-TRIFLUOROMETHYL-4-NITROPHENOL) ON EMBRYONIC DEVELOPMENT OF THE RAINBOW TROUT (*SALMO GAIRDNERI*, RICHARDSON). *Water Res.* 14(5):515-519. 1980. SFA 25(3)
[Proctor & Redfern Group, 75 Eglinton Ave. East, Toronto, ON M4P 1H3, Canada] Toxicity of the lamprey larvicide TFM to rainbow trout embryos was found to be greatest immediately following fertilization and least after neurulation. Embryonic mortality in the early stages was delayed and not recognized by the presence of a white protein precipitate.

80-002384 Serns, S. L. EFFECTS OF PRO-NOXFISH® ON THE BENTHOS AND ZOOPLANKTON OF BUG LAKE, FOREST COUNTY, WISCONSIN. *Water Resour. Bull.* 5(2). Oct. 1979. SFA 25(3)
[Box 440, Woodruff, WI 54568] A concentration of 2.5 mg/l Pro-Noxfish® (0.063 mg/l rotenone and 0.063 mg/l sulfoxide) was applied to Bug Lake, Wisconsin, on November 17, 1975. There was an immediate toxicity to zooplankton and *Chironomus*. All taxa of benthic organisms and zooplankton that were present before toxicant application survived the treatment except for *Pleuroxus denticulatus* which was collected in only one sample before treatment. Comparable densities of benthic and zooplankton taxa were found on individual sampling dates before and after treatment; however, mean densities of trichopterans and dipterans were lower after treatment. The high variance in the samples along with the change in fish population after treatment are believed responsible for this indicated change in benthos density rather than the effects of the rotenone.

RESEARCH AND MANAGEMENT-GENERAL

80-002385 Anderson, L. G. NECESSARY COMPONENTS OF ECONOMIC SURPLUS IN FISHERIES ECONOMICS. *Can. J. Fish. Aquatic Sci.* 37(5):858-870. May 1980. In English with French summ. SFA 25(3)
[Dep. Econ., Univ. Del., Newark 19711]

80-002386 Hulbert, P. J. and E. Engstrom-Heg. HOOKING MORTALITY OF WORM-CAUGHT HATCHERY BROWN TROUT. *N.Y. Fish Game J.* 27(1):1-10. Jan. 1980. SFA 25(3)
[N.Y. State Dep. Environ. Conserv., Stamford 12167] The mortality of sub-legal (in New York) brown trout taken by angling with worm-baited hooks of five different sizes was investigated, using age 1+ hatchery-reared fish

RESEARCH AND MANAGEMENT-GENERAL (CONTINUED)

80-002386 CONTINUED released in late spring in a small pond. Comparable numbers were handled with wet or dry hands, and the hooks were removed manually, except that for some that had been deeply hooked the leaders were clipped. The fish were then held in aquaria together with control fish for 14 days and their mortality was recorded. The data were analyzed according to whether the fish had been lightly hooked or deeply hooked. Two-thirds of the trout taken were lightly hooked, and their mortality (0.9 per cent) was not significantly different from that of the controls. For deeply hooked trout, the mortality was 59 per cent when the hooks were removed but only 18 per cent when the leaders were clipped. The data suggest that, for all the trout taken, the short-term mortality would have been about 22 per cent if all hooks had been removed by hand but only about 7 per cent if the leaders had been clipped on all deeply hooked fish. Handling with wet or dry hands had little effect on mortality. The leader-clipped specimens that survived the initial test period were held over the summer and, while additional mortality occurred, all fish surviving the summer were able to feed and grow.

80-002387 Mason, W. T., Jr.; C. T. Cushwa; L. J. Slaski and D. N. Gladwin. A PROCEDURE FOR DESCRIBING FISH AND WILDLIFE CODING INSTRUCTIONS FOR PENNSYLVANIA. (2 vol.). *U.S. Fish Wildl. Serv.* FWS/OBS-79/19. ix + 21p. Dec. 1979. SFA 25(3)
[U.S. FWS, Eastern Energy Land Use Team, Route 3, Box 44, Kearneysville, WV 25430]

ADMINISTRATION AND PLANNING

80-002388 Horak, G. C. and J. E. Olson. THE NEED FOR STANDARDS AND CRITERIA TO DETERMINE EFFECTIVENESS AND RECOMMENDATIONS FOR REPORTING REQUIREMENTS. *Fisheries (Bull. Am. Fish. Soc.)* 5(3):2-5. May-June 1980. SFA 25(3)
[Environ. Control, Inc., 1520 E. Mulberry, Fort Collins, CO 80524] The water resource planning process as outlined by Federal legislation is incomplete. There is no provision for systematic monitoring to insure that measures for the protection of fish and wildlife are implemented, and that the measures successfully maintain and improve the resource. The need for standards and criteria to determine effectiveness is discussed in this paper. Annual reports by the project-sponsoring agency to detail the status and results of the measures are recommended.

80-002389 PROCEEDINGS OF THE WESTERN ASSOCIATION OF FISH AND WILDLIFE AGENCIES AND THE WESTERN DIVISION AMERICAN FISHERIES SOCIETY. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 59:vii + 258p. 1979. SFA 25(3)
A collection of papers dealing primarily with State-Federal relations, especially regarding Alaska.--RS.

REPORTS OF FISHERY STATIONS, STATES, ETC.

80-002390 Pacific Marine Fisheries Commission. 32ND ANNUAL REPORT OF THE PACIFIC MARINE FISHERIES COMMISSION. *Pac. Nar. Fish Comm. Annu. Rep.* 32. 49p. May 1980. SFA 25(3)
[528 S.W. Mill St., Portland, OR 97201]

HABITAT ALTERATIONS

80-002391 Berry, C. R., Jr. THE VALUE OF HABITAT IMPROVEMENT DEMONSTRATION AREAS FOR INFORMING THE PUBLIC. *Fisheries (Bull. Am. Fish. Soc.)* 5(3):22-25. May-June 1980. SFA 25(3)
[Utah Coop. Fish. Res. Unit, Utah State Univ., Logan]

80-002392 Clugston, J. P., ed. PROCEEDINGS OF THE CLEMSON WORKSHOP ON ENVIRONMENTAL IMPACTS OF PUMPED STORAGE HYDROELECTRIC OPERATIONS. *U.S. Fish Wildl. Serv.* FWS/OBS-80/28. iv + 206p. Apr. 1980. SFA 25(3)
[U.S. FWS, Southeast Reservoir Invest., 206 Highway 123 By-Pass, Clemson, SC 29631]

80-002393 Gislason, J. C. EFFECTS OF FLOW FLUCTUATION DUE TO HYDROELECTRIC PEAKING ON BENTHIC INSECTS AND PERIPHYTON OF THE SKAGIT RIVER, WASHINGTON. *Ph.D. dissertation, Univ. Wash.* 175p. 1980. From Diss. Abstr. Int. B Sci. Eng. 40(12, part 1):5539. June 1980. SFA 25(3)

80-002394 Guillebeau, T. M.; H. L. Stirewalt; K. F. Nearhoof; F. L. Nearhoof; D. M. Adams and E. A. Lamar. A SECOND YEAR STUDY OF THE EFFECTS OF RECHANNELIZATION ON THE PLANKTONIC AND BENTHIC ORGANISMS IN THE SAVANNAH RIVER: PART I. *Ga. J. Sci.* 38(2):92. Apr. 1980. Abstract only. SFA 25(3)
[Augusta Coll., Augusta, GA] During an eight month period in 1979, six plankton samples and eleven bottom samples were collected from three representative areas within the Coastal Plain region of the Savannah River. The plankton samples were obtained with a 70 micron mesh quantitative sampling net and the benthic organisms were sampled with an Ekman dredge. Upon application of Student's t-test to the plankton data for 1979, differences of 90% or better were revealed in two of six comparisons. (Plankton analysis for 1978 revealed no significant differences in eight comparisons.) In 1979, application of the Mann-Whitney U-test to the analysis of the benthic organisms revealed no significant differences. Analysis of samples taken in 1978 revealed no significant differences in all comparisons.

80-002395 Hunt, R. L. REMOVAL OF WOODY STREAMBANK VEGETATION TO IMPROVE TROUT HABITAT. *Wis. Dep. Nat. Resour. Tech. Bull.* No. 115. 36p. 1979. SFA 25(3)
[Rt. 1, Box 589, Waupoca, WI 54981] Woody vegetation, primarily speckled alder (*Alnus rugosa*), was removed at ground level from 30-ft strips paralleling both banks of three small trout streams to improve trout habitat, trout populations and fishing. In all three streams, despite variations in discharge and trout abundance, posttreatment growth rates of most age groups of trout were slightly better in Treatment Zones then in Reference Zones. Prior to brushing, Treatment Zone growth rates were usually less than in Reference Zones. Angling use and exploitation rates increased in all study zones on the Little Plover River during the posttreatment phase of creel census (1976 only) compared to the two seasons of pretreatment creel census (1970 and 1972). Increased harvest of a previously lightly exploited stock was the only benefit for the sport fishery of removing woody streambank vegetation. No census was conducted on the other two study streams. Unanticipated extremes in streamflow variation confounded planned evaluations of changes in trout stocks, trout habitat and the sport fishery in response to removal of woody streambank vegetation. But in retrospect these conditions provided bonus insights that increased the previous limited knowledge of the impact that abnormally low stream flows have on trout stream ecosystems in Wisconsin. In all study zones of the Little Plover River, fall biomass of brook trout and mean summer flow (June through August) were significantly correlated; so too were maximum summer temperature and

HABITAT ALTERATIONS (CONTINUED)

80-002395 CONTINUED mean summer discharge. As an overview assessment of this pioneering experiment to improve trout habitat and sport fishing on small, heavily shaded trout streams in Wisconsin, I conclude that the technique has enough practical management application to merit additional testing of the kind used in my study (preferably during periods of more stable stream discharge) and experimentation with less severe modifications of shade canopy.--From abstr.

80-002396 Labaugh, J. W. WATER CHEMISTRY CHANGES DURING ARTIFICIAL AERATION OF SPRUCE KNOB LAKE, WEST VIRGINIA. *Hydrobiologia* 70(3):201-216. 2 May 1980. SFA 25(3)

[USGS, Mail Stop 413, Denver Fed. Cent., Denver, CO 80225] The water mass below 3.5 m in Spruce Knob Lake was artificially aerated with a modified full lift aerator during two consecutive summers (1974 and 1975) of an investigation that began in July of 1973 and ended in September, 1975. Artificial aeration increased water temperature below 3.5 m without causing destratification. Several chemical parameters were significantly affected by artificial aeration, especially from July to autumnal overturn in 1974 and 1975. Below 3.5 m, total inorganic carbon, total alkalinity, nitrite, soluble reactive phosphorus, and total phosphorus, were lower during aeration than in the summer of no aeration (1973). Although artificial aeration lowered soluble reactive and total phosphorus, there was no significant impact on the phosphorus budget of the impoundment. In 1975, continuous aeration from vernal overturn to autumnal overturn resulted in higher nitrate concentrations below 3.5 m than in the preceeding summers. Lower pH values encountered through the whole water column in 1975 followed a brief isothermal interruption of summer stratification in early June. There was no direct effect of artificial aeration on either temperature or water chemistry parameters in the epilimnion. Significantly lower chlorophyll concentrations observed in 1975 were related to destratification in June. Primary production was unaffected by aeration.

80-002397 Mauney, M. and G. L. Harp. THE EFFECTS OF CHANNELIZATION ON FISH POPULATIONS OF THE CACHE RIVER AND BAYOU DEVIEW. *Arkansas Acad. Sci. Proc.* 33:51-54. 1979. SFA 25(3)

[Dep. Fish. Sci., VPI&SU, Blacksburg, VA 24061] This study was designed to better understand the possible effects of channelization by comparing natural and previously channelized sections of the Cache River and Bayou DeView. Forty-five fish species were collected in natural reaches, but only 24 species were collected in channelized reaches. *Cyprinus carpio* and *Dorosoma cepedianum* constituted 40 and 20 percent of the total fish biomass in channelized reaches, respectively, but only 22 and 2 percent of the total biomass in natural reaches. The mean weight of total fishes and game fishes only per surface ha in natural sections were 276 and 46 kg, respectively, but these values in channelized sections were only 88 and 2 kg, respectively. Mean species diversity indices for natural and channelized sections of the Cache River were 3.1 and 1.8, respectively, and mean redundancy values for these sections were .30 and .55, respectively. Species diversity indices and redundancy values for Bayou DeView followed this trend.

80-002398 Mauney, M. and J. J. Ney. IMPACT OF IMPOUNDMENT ON DOWNSTREAM FISH AND BENTHIC MACROINVERTEBRATE COMMUNITIES IN A PIEDMONT STREAM. *Va. J. Sci.* 30(2):77. 1979. Abstract only. SFA 25(3)

[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] Impact of a shallow, non-stratifying impoundment on stream biota was assessed through a one-year comparison of upstream and downstream stations. Stream physico-chemical properties were not altered. Estimated density, biomass, and production of the benthic community were greater in the tailwater than at the upstream or most downstream station and occurred primarily through increase in

HABITAT ALTERATIONS (CONTINUED)

80-002398 CONTINUED non-insect groups. Changes in macroinvertebrate composition appeared to be related to differences in food availability. The taxonomic composition of the fish community was similar among stations, but fish biomass was substantially greater in the tailwaters than at the other locations. The fish community in the tailwaters was not stable. Increased fish biomass and instability in the tailwaters may result from upstream movement and reservoir emigration. Transience may be enhanced by competition for food and/or space during some seasons. The downstream impact of the reservoir was very localized. Benthic and fish communities examined 1200 m below the impoundment were equivalent to upstream levels or were intermediate between those of the upstream and tailwater station.

80-002399 Mealing, H. C. III; H. L. Stirewalt; A. G. Woodward; J. R. Zets and R. J. Zets. THE EFFECTS OF RECHANNELIZATION ON THE DIET OF SOME GAME FISHES WITH A SUMMARY OF DATA OBTAINED FOR TWO YEARS: PART II. *Ga. J. Sci.* 38(2):92-93. Apr. 1980. Abstract only. SFA 25(3)
[Augusta Coll., Augusta, GA] Fifty-two fishes were collected primarily by the use of environmental-sampling gill nets from representative sites of the Upper, Middle, and Lower Coastal Plains of the Savannah River. Following laboratory classification and quantification of stomach contents, Student's t-test was applied which indicated significant differences at the 90% level or better in six of seven comparisons for 1979. Analysis for 1978 showed a significant difference at the 80% confidence level or better in four of twelve comparisons.

80-002400 Mulvihill, E. L.; C. A. Francisco; J. B. Glad; K. B. Kaster and R. E. Wilson. BIOLOGICAL IMPACTS OF MINOR SHORELINE STRUCTURES ON THE COASTAL ENVIRONMENT: STATE OF THE ART REVIEW. VOL. II. *U.S. Fish Wildl. Serv.* FWS/OBS-77/51. viii + 306p. Mar. 1980. SFA 25(3)
[Beak Consultants, Inc., 317 S.W. Alder, Portland, OR 97204]

80-002401 Mulvihill, E. L.; C. A. Francisco; J. B. Glad; K. B. Kaster and R. E. Wilson. BIOLOGICAL IMPACTS OF MINOR SHORELINE STRUCTURES ON THE COASTAL ENVIRONMENT: STATE OF THE ART REVIEW. VOL. I. *U.S. Fish Wildl. Serv.* FWS/OBS-77/51. viii + 156p. Mar. 1980. SFA 25(3)
[Beak Consultants, Inc., 317 S. W. Alder, Portland, OR 97204] Beak Consultants Incorporated conducted a state of the art review of the biological impacts of minor shoreline structures on the coastal environment. The types of structures included in this study were as follows: breakwaters, jetties, groins, bulkheads, revetments, ramps, piers and other support structures, buoys and floating platforms, harbors for small craft, bridges and causeways. A total of 555 information sources were obtained at which approximately 220 references were found by commercial bibliographic searches. Other sources were located by cross referencing from identified sources; visiting key libraries; interviewing and sending questionnaires to institutions, government agencies, and individuals who might have had useful information. Information was extracted from the literature and compiled by type of shoreline structure and by coastal region. The following categores of information were sought: structure functions; site characteristics; geographic prevalence; engineering, socioeconomic and biological placement constraints; construction materials; expected life span; environmental conditions; methodology of environmental impact studies; physical and biological impacts; and structural and nonstructural alternatives. Existing information was evaluated and a text was prepared (Volume I). An annotated bibliography, keyword index, and primary author reference number index were produced from the data base (Volume II). This state of the art review summarizes and evaluates the information found in the literature for each type of structure. Areas requiring additional study are delineated. Germane

HABITAT ALTERATIONS (CONTINUED)

80-002401 CONTINUED studies in progress are identified, and selected case histories depicting the impacts of shoreline structures are presented as part of the review. The impact of any structure on the coastal environment is site-specific and should be considered on a case-by-case basis. Few studies were found which quantitatively investigated the impacts of specific structures. Structures which appear to have the greatest potential for impacting the coastal environment are small boat harbors, bridges and causeways, bulkheads, breakwaters, and jetties. Those with moderate impact potential are revetments, groins, and ramps. Low-impact potential structures include buoys and floating platforms, and piers, pilings and other support structures. Based on this classification scheme and the number and types of information sources located, bridges, causeways, and small boat harbors have received very little study relative to their potential impacts.

80-002402 Slade, E. A., J. B. Harper, K. S. Clark and G. E. Stanton. EFFECTS OF URBANIZATION ON ROARING BRANCH CREEK. Ga. J. Sci. 36(2):93. Apr. 1980. Abstract only. SFA 25(3)

[Columbus Coll., Columbus, GA] Roaring Branch Creek, located in northwest Columbus, Georgia, has been of concern to local residents for some time due to its flooding potential and value as a natural corridor. This concern created the foundation for the study conducted during the summer of 1979 to determine the baseline ecology of Roaring Branch Creek. In addition, comparisons were undertaken between the ecology of the Roaring Branch Ecosystem and the ecology of Lindsey Creek, a nearby stream of similar origin, but which has already been urbanized. The most obvious chemical pattern was one in which mean concentrations of chemicals were highest at the industrial park site especially iron and manganese. Microbiological data indicated total fecal coliform exceeded the state Environmental Protection Division's safety limit at all sites in both creeks on all dates. Lindsey Creek had significantly greater mean densities and biomass of invertebrates than Roaring Branch, due largely to the high density of Bivalvia, Trichoptera, principally from the family Hydropsychidae, closely dominated the benthic invertebrate fauna of Roaring Branch Creek. The fish of Roaring Branch were warm water species: centrarchids, ictalurids and cyprinids. Lindsey Creek has significantly larger mean densities and biomass than Roaring Branch Creek, even considering the fact that no fish were collected at a concrete channelized site.

HARVEST, CREEL CENSUS, ETC.

80-002403 Carla, E. C. COMPARATIVE CHARACTERISTICS OF SURF FISHERMEN AND BOAT FISHERMEN ON LONG ISLAND, NEW YORK. N.Y. Fish Game J. 27(1):51-62. Jan. 1980. SFA 25(3)

[Dep. Recreation Parks, Tex. A&M Univ., College Station] Participation in sport fishing and over-all satisfaction with the angling experience depends on several interacting environmental, economic and psycho-social factors. Surveys of surf fishermen and boat fishermen on Long Island (N.Y.) provided data on the characteristics of these fishermen and on several associated variables relating to their attitudes, interests and behaviour. In many basic ways, the two groups are similar in their fishing habits and expectations, but there are enough important differences to warrant considering them as distinct groups with separate needs for enjoying their sport. The findings should be useful to those responsible for natural-resource administration, as well as have value for commercial sport fishing industries in the area.

HARVEST, CREEL CENSUS, ETC. (CONTINUED)

80-002604 Ernst, D. and T. C. Osborn. THE SUMMER SPORTFISHERY in VOYAGEURS NATIONAL PARK AND SURROUNDING WATERS FOR 1977 AND 1978. Minn. Dep. Nat. Resour. Fish Sect. Investt. Rep. No. 370. 37p. Apr. 1980. ERA 25(3)
[Rt. 9, Box 217, International Falls, MN 56649] A creel census on the lakes which comprise or are associated with Voyageurs National Park was conducted during the summers of 1977 and 1978 to provide baseline data on the sport fishery. Of the five lakes censused, two, Crane and Kabetogama, are located wholly within the U.S., and three, Namakan, Rainy and Sand Point are U.S.-Canadian border lakes. The census, a nonuniform sampling type, was quantitative except for the Canadian portion of Rainy Lake which is accessible from Canada. Total fishing effort averaged 7.4 manhours per acre. U.S. waters averaged 8.3 manhours per acre and Canadian waters averaged 1.7 manhours. Fishing pressure on individual lakes ranged from 20.8 manhours per acre on Kabetogama to 6.9 on Namakan Lake (Rainy excluded). More than half of all fishing trips were made on Kabetogama Lake. Fifty-four percent of all fishermen were non-residents. The fishery on each of the lakes was similar in that walleye and northern pike were the principal species in the catch but the yields from each lake varied widely. The highest average annual yield was from Crane Lake (6.9 lbs. per acre); the walleye yield was 5.6 lbs. per acre and the northern pike yield was was 1.3 lbs. per acre. The U.S. waters of Rainy Lake yielded an average of 0.3 lbs. per acre of walleye and 0.4 lbs. per acre of northern pike; the total harvest was less than 0.8 lbs. per acre. The age class structure of the walleye harvest was similar from all lakes. Age III and IV walleye comprised the bulk of the catch. The average age of walleye harvested was about 4.5 years.

80-002605 FAO of the UN. 1978 YEARBOOK OF FISHERY STATISTICS. CATCHES AND LANDINGS. FAO Fish. Ser. 10:a + 372p. 1979. ERA 25(3)
[Rome, Italy]

80-002606 Koring, J. H. DESCRIPTION OF RECAPTURES OF TAGGED RAINBOW TROUT FROM AN OREGON STREAM. Prog. Fish-Cult. 42(2):113-115. Apr. 1980. ERA 25(3)
[Or. Coop. Fish. Res. Unit, Dep. Zool., Univ. Or., Corvallis 97331]

80-002607 Penn, P. H. and D. Lawson. CHARACTERISTICS OF SPORT AND COMMERCIAL FISHERMEN RESIDING IN EASTERN LONG ISLAND, NEW YORK. N.Y. Fish Game J. 27(1):76-85. Jan. 1980. ERA 25(3)
[N.Y. State Dep. Environ. Conserv., Bur. Fish., Watertown 13601] A multiple-choice questionnaire designed to obtain information on fishermen living on eastern Long Island and their angling preferences was mailed to a random sample of households in the towns of Riverhead, Southold, Southampton, Shelter Island and East Hampton. Of 1,823 questionnaires delivered, 46 per cent were completed and returned, and from the data it was estimated that there were 50,700 saltwater anglers residing in the five towns surveyed. Respondents averaged 22 trips per year of which 96.6 per cent were one day or less in duration, representing an estimated 1,114,500 fishing trips by local anglers in 1977 at an expense of some $12,261,600. A substantial proportion of the recreational fishermen (80.9 per cent) favored a saltwater fishing licensee, and 81.6 per cent favored regulations fixing minimum size and daily catch limits. Response by commercial fishermen was poor (5 per cent), but respondents strongly favored establishing exclusive fishing areas, licensing recreational shellfishermen, and a marine commercial fishing licensee if the revenues from it were for expanding shellfish beds.

REGULATIONS

80-002608 Parker, L. D., P. H. Rao and J. F. McCormick. EFFECTS OF

ORIENTATIONS (CONTINUED)

80-002600 CONTINUED UNDIMENSIONAL SIZE LIMITS ON THE GROWTH RATE OF TROUT. Can. J. Fish. Aquatic Sci. 37(5):673-676. May 1980. In English with French summ. SFA 25(3)
[Dep. Phys., Wayne State Univ., Detroit, MI 48202]

MARKING AND TAGGING

80-002609 Lukas, R. W. SONARSONDE PLOT: A COMPUTER-BASED SYSTEM FOR 3-D PLOTTING OF MOVEMENTS OF ACOUSTICALLY TAGGED ANIMALS. M.S. Thesis, Calif. State Univ. 127p. 1979. From Masters Abstr. 18(2):74. June 1980. SFA 25(3)
An 3-D plotting system was developed to monitor the movements of free-swimming sharks tagged with ultrasonic transmitters. Times-of-arrival of ultrasonic pulses between two omnidirectional hydrophones and a reference timing oscillator are field recorded on magnetic tape. Laboratory processing involves three computer issues, misc. small and a digital plotter to generate the second-by-second plots. Theoretical angular resolution ranges from ±0.3° at 90° to ±4.6° at 0° and 180°. Distance resolution is ±0.1 m for 0-51 m or ±0.5 m for 0-255 m. In the most useful plotting sector (about 20-160°, within 50 m), real-data 3-D plots showed an achievable system accuracy close to the above, i.e., within approximately ±1 m, and a jitter of ±0.2 to 0.5 m. Tests confirmed the system's usefulness for plotting shark movements in both confined and open environments. Limitations are discussed and improvements suggested.

80-002610 Shaklee, M. A PORTABLE BLACK-LIGHT BOX FOR DETECTING FLUORESCENT PIGMENT ON FISH. Calif. Div. Wildl. Fish. Inf. Leaflt. No. 11. 2p. Apr. 1980. SFA 25(3)
[Calif. Div. Wildl., 317 W. Stewart, Fort Collins, 80526]

80-002611 Smith, D. IS RADIO-TAGGING A VIABLE TECHNIQUE FOR COLORADO SQUAWFISH? Final Proj. Rept. Desert Fish. Coopr. 13-87. 30 Jan. 1980. Abstract only. SFA 25(3)
[Bio/West, Inc., Logan, UT]

STOCKING AND INTRODUCTION

80-002612 Reynolds, L. A. CONTRIBUTION TO THE SPECIES' CASES OF NORTHERN-REARED HATCHERY FISH STOCKED AS FINGERLINGS IN LAKE LAKE, BARRY COUNTY, MICHIGAN. Mich. Dep. Nat. Resour. Fish. Res. Rep. No. 1875. 22p. 27 Feb. 1980. SFA 25(3)
[Mich. Dep. Nat. Resour., Fish Laboratory] From 1971 to 1975 marsh-reared northern pike were stocked into Long Lake, Barry County, at the average rate of 40 fingerlings per hectare, per year, at a cost of $0.25 each. Survival of these fish to the anglers' creel varied from 0.8 to 36.0% (mean, 11.7%). The harvest of each year class was economically rewarding a years after stocking. Marsh-reared fish provided 47.7% of the total harvest from the 1970-75 year classes of northern pike. The cost to produce the harvested marsh-reared northern pike was $0.07 per fish, or $0.70 per kilogram. During the study the growth of specific cohorts within the adolescent range for northern Michigan lakes. There was no distinction in harvest of specific cohorts between those that could be ascribed to abundance of northern pike.

STOCKING AND INTRODUCTIONS (CONTINUED)

80-002612 CONTINUED ... It was suggested that the stocking rate of northern pike could be increased to 8,000 fingerlings (58.4 per hectare) with no detrimental effect on other fish species in Long Lake.

80-002613 Hilton, E. T. and D. E. Jonasson. RETURN TO THE FISHERY AND ESCAPEMENT OF ADULT COHO SALMON FROM ACCELERATED JUVENILES RELEASED IN THE FALL OF 1974. Can. Dep. Fish. Oceans Pacif. Reg. Ms. Rep. 943. iv + 11p. May 1980. In English with French summ. DFO [illegible]

[Per. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] During the summer of 1974, approximately 12,000 coho were accelerated to the smolt stage through control of temperature, photoperiod, and feeding rate at Rosewall Creek on Vancouver Island. The fish were marked, coded-wire-tagged and released on November 6, 1974. Early maturing male (jack) and normal-aged (adult) coho originating from these releases were recovered in the escapement and in the fishery. The total return of adults of 6.44% from the fall release (November 6) of 10-g accelerated 11-mo-old smolts was compared with the returns from a spring release (June 20) of 9-g accelerated 6-mo-old and 19-g normally reared 18-mo-old smolts. The return from the fall accelerated smolts was double that from the spring accelerated smolts (3.3%). Both these returns were far below the return of 47.5% from the June release of normally reared (18 mo) smolts. Among the accelerated fish females predominated (66%) among adults from the fall release, the reverse being true for the spring release with 64% males. Also, adults from the fall release were larger than those from the spring release, but smaller than those from the normally reared smolts. Results of these studies indicate that rearing of accelerated smolts is at present not economically advantageous.

80-002614 Hilton, E. T. RETURN OF ADULT COHO SALMON IN RELATION TO MEAN SIZE AND TIME AT RELEASE OF JUVENILES TO THE ESTUARY AND THE ESCAPEMENT. Can. Dep. Fish. Oceans Pacif. Reg. Ms. Rep. iv + 41p. May 1980. In English with French summ. DFO [illegible]

[Per. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] An experiment was conducted to determine the effects of time and size at release of juvenile coho salmon on their subsequent survival, growth, and age at maturity. Four releases of marked and tagged coho salmon smolts were made from Rosewall Creek, Vancouver Island, April 16, May 12, June 10, and July 8, 1975. In the fall of 1975, 1,417 tagged jacks (age 1.0) were recovered and in the fall of 1976, 2,865 tagged adults (age 1.1) were recovered at Rosewall Creek. In addition, 21,000 fish were estimated to have been caught by the fishery during 1975 and 1976. Abundance of these returns with special reference to the production of jacks and adults indicated that the yield of jack biomass was positively correlated with the size of smolts released. Larger smolts at release returned more heavily as jacks. Jack size and smolt size were also positively correlated. Somewhat larger smolts not only produced a greater percentage of jacks, they also were of a larger size. Later releases produced fewer jacks than did early releases. Since jack production is favoured by large smolts released early, furthermore, the production of jacks reduced the production of adults, it subsequently a highly significant positive correlation between the proportion of jacks represented in the total return and the average smolt size. The larger smolts at release did not produce more adults. Smolt size and time of release did, however, have a positive influence on adult size. Larger smolts of early releases returned as larger adults. In the hopes of finding data, an attempt was made to estimate which combination of time of release and smolt size produced the highest return of adult biomass per [illegible] smolts. In general, the greatest adult biomass was achieved from smolts of a medium size (20-24 g) released late in the season (early June). The highest production of jack biomass was achieved by the release of large smolts early. On an average, the fishery caught [illegible] of the fish that returned from the [illegible] releases. With the exception of

[illegible] 1980

STOCKING AND INTRODUCTIONS (CONTINUED)

80-002414 CONTINUED fish from the July release, the fishery tended to select a higher proportion of the larger fish from each population. For the July smolts there was a tendency for selection of the small fish. The proportion of fish from the four releases caught in the Georgia Strait sport fishery ranged from 41% for the April release to 59% for the July release. The proportion of fish from each release caught off the west coast of Vancouver Island tended to decrease in the later releases. The percentage of fish from the four releases caught in Southern United States net, troll and sport fisheries (California, Oregon and Washington) averaged 11%, ranging from 9% of the May fish to 12% of the July fish.

80-002415 McCoid, M. J. and J. A. St. Amant. NOTES ON THE ESTABLISHMENT OF THE RAINWATER KILLIFISH, *LUCANIA PARVA*, IN CALIFORNIA. *Calif. Fish Game* 66(2):126-125. Apr. 1980. SFA 25(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

80-002416 Pelzman, R. J. IMPACT OF FLORIDA LARGEMOUTH BASS, *MICROPTERUS SALMOIDES FLORIDANUS*, INTRODUCTIONS AT SELECTED NORTHERN CALIFORNIA WATERS WITH A DISCUSSION OF THE USE OF MERISTICS FOR DETECTING INTROGRESSION AND FOR CLASSIFYING INDIVIDUAL FISH OF INTERGRADED POPULATIONS. *Calif. Fish Game* 66(3):133-162. July 1980. SFA 25(3)
[Calif. Dep. Fish Game, 1701 Nimbus Rd., Rancho Cordova 95670] Florida largemouth bass, *Micropterus salmoides floridanus*, had a notable genetic impact following their introduction into five northern California waters containing northern largemouth bass, *M. s. salmoides*, populations: Folsom Lake, New Hogan Reservoir, Lake Amador, Lake Isabella, and Clear Lake. Analysis of malate dehydrogenase isozyme patterns of fish systematically collected in years subsequent to the introduction indicated that intergraded populations developed at each of the waters. Incidence of the Florida allele at the study waters, based on malate dehydrogenase analyses, eventually ranged from 0.35 at Lake Amador to 0.52 at both New Hogan Reservoir and Clear Lake. Discriminant function analysis of meristic data for fish of known electrophoretic phenotype showed that meristic values were not reliable for classifying individual fish from mixed populations as to Florida, northern, or hybrid bass categories. This was supported by meristic data for known F, hybrids. Hybridization could not necessarily be detected by an increase in mean meristic value or by unimodality of a frequency distribution of meristic values. The mode value of lateral line scale counts appeared to be the best meristic indicator of hybridization. Information from this study and from a similar study at southern California waters indicates that introductions of Florida bass into northern bass populations have generally been beneficial through reducing high exploitation rates, increasing the mean size of bass in the catch, and providing exceptional fishing for trophy-sized bass at some waters. Results of this study indicate that current largemouth bass populations at the study waters possess a wider spectrum of performance capabilities through the inclusion of desirable traits attributed to Florida bass. This is particularly advantageous in the reservoir setting where heavy angling pressure, water level manipulation, competition of prey species with small bass, and other factors work against the maintenance of a bass population.

FISHING GEAR AND TECHNIQUES

80-002417 Regnaul, T. D. EIFAC FISHING GEAR INTERCALIBRATION EXPERIMENTS. *EIFAC Tech. Pap. No.* 34. vi + 97p. 1978. SFA 25(3)
[Freshwater Biol. Assoc., Windermere Lab., Ambleside, Cumbria LA22 0LP, England]

FISHING GEAR AND TECHNIQUES (CONTINUED)

80-002418 Dauble, D. D. and R. H. Gray. COMPARISON OF A SMALL SEINE AND A BACKPACK ELECTROSHOCKER TO EVALUATE NEARSHORE FISH POPULATIONS IN RIVERS. *Prog. Fish-Cult.* 42(2):93-95. Apr. 1980. SFA 25(3)
[Freshwater Sci., Ecol. Sci., Pac. Northwest Lab., P.O. Box 999, Richland, WA 99352]

80-002419 Hall, R. E. and L. Durham. MULTIPLE METHOD ESTIMATES OF FISH POPULATIONS IN A SMALL POND. *Trans. Ill. State Acad. Sci.* 72(2):74-80. 1979. SFA 25(3)
[WAPORA, Inc., R.R. 2, Charleston, IL 61920] Single and multiple capture-recapture procedures were undertaken using hoop nets, gill nets, seining, and electroshocking to sample the fish populations. Multiple-method procedures were employed to study their effects on capturing selectivity and differential vulnerability to capture. Multiple procedures, which involved capture and recapture with two or more sampling methods, yielded more unbiased and accurate population estimates than single method procedures.

80-002420 Houk, J. L. A DIVER-OPERATED SNAGGING DEVICE FOR CAPTURING LINGCOD, *OPHIODON ELONGATUS*. *Calif. Fish Game* 66(3):187-188. July 1980. SFA 25(3)
[Mar. Cult. Lab., Calif. Dep. Fish Game, Granite Canyon, Coast Route, Monterey 93940]

80-002421 Leclerc, J. and G. Power. SELECTIVITY OF FLY-FISHING, SPINNING AND GILLNET FOR BROOK CHARR AND OUANANICHE IN A LARGE NORTHERN QUEBEC RIVER. *Environ. Biol. Fishes* 5(2):181-184. 22 Apr. 1980. SFA 25(3)
[Cent. Etud. Nord., Univ. Laval, PQ G1K 7P4, Canada] A comparison between fly-fishing, spinning and short 51 mm and 25 mm gill nets showed that fly-fishing was the least selective method of sampling brook charr, *Salvelinus fontinalis*, and ouananiche, *Salmo salar*, in rapid sections of the Caniapiscau River, north central Quebec. Angling techniques had the added advantage of mobility which allowed rapids to be more evenly covered during sampling. Selectivity curves for the capture of brook charr by fly-fishing, spinning and a 51 mm mesh gill net are presented.

80-002422 Matuda, K. [MOVING SPEED OF BOTTOM DRIFT NET.] *Bull. Jpn. Soc. Sci. Fish.* 46(3):275-280. Feb. 1980. In Japanese with English summ. SFA 25(3)
[Tokyo Univ. Fish., 5-7, Konan-4, Minato-ku, Tokyo 108, Japan]

80-002423 Serns, S. L. RELATIONSHIP OF WALLEYE FINGERLING DENSITY AND ELECTROFISHING CATCH PER EFFORT IN NORTHERN WISCONSIN LAKES. *Wis. Dep. Nat. Resour. Fish Manage. Rep.* 104. Sept. 1979. SFA 25(3)
[P.O. Box 440, Woodruff, WI 54568] Investigations conducted on 13 northern Wisconsin lakes over a seven year period revealed a significant positive linear relationship between walleye fingerling catch per effort by electrofishing and fingerling density (both in number per acre and number per mile of shoreline). The best formula for describing fingerling density (number per acre) was: Y = 0.194 X, where Y = fingerling density and X = fingerling catch per mile of shoreline with an electroshocker (catch per effort). Electrofishing efficiency was negatively correlated with lake surface area and shoreline length. Efficiency was not related to conductivity, shoreline development factor, fingerling CPE or fingerling density. The mean total length of native walleye fingerlings was not related to fingerling density or lake conductivity.

FISHING GEAR AND TECHNIQUES (CONTINUED)

80-002424 Tanida, K. ON THE RHEOLOGY OF NETTING TWINE--V. 4 ELEMENT MODEL. *Bull. Jpn. Soc. Sci. Fish.* 46(3):281-287. Feb. 1980. SFA 25(3)
[Tokyo Univ. Fish., 5-7, Konan-4, Minato-ku, Tokyo 108, Japan]

80-002425 Weinstein, M. P. and R. W. Davis. COLLECTION EFFICIENCY OF SEINE AND ROTENONE SAMPLES FROM TIDAL CREEKS, CAPE FEAR RIVER, NORTH CAROLINA. *Estuaries* 3(2):98-105. June 1980. SFA 25(3)
[Dep. Biol., Va. Commonwealth Univ., Richmond 23284] Efficiency, defined as the percentage of the total number of individuals captured from a known area of tidal creek (blocked with seines), was studied on six occasions from December 1976 through August 1978. Sampling was conducted at two stations near the Cape Fear River, Southport, North Carolina using either seines or rotenone. For the three most abundant species collected by each method, the range for seine efficiencies (60.6 ± 19.4 to 78.0 ± 9.4%) was generally narrower than that for rotenone (29.6 ± 9.5 to 97.7 ± 14.8%). However, overall species richness was better represented by rotenone, the mean percentage of species captured for all samples was 92.1% versus 70.3% for seines. Consistent patterns in efficiency for individual species with regard to size, age, or water temperature were absent. A comparison of individual collections with that of the sample "universe" trapped between the block nets indicated that a representative sample of the extant nekton community was taken by each method.

80-002426 Wohlgemuth, E. ON SELECTIVITY OF GILL NETS FOR, AND CERTAIN BIOLOGICAL PARAMETERS OF, *ALBURNUS ALBURNUS* AND *RUTILUS RUTILUS*. *Folia Zool.* 29(4):371-383. 1979. In English with Russian summ. SFA 25(3)
[Inst. Vert. Zool., Czechoslovak Acad. Sci., Brno, Czechoslovakia]

80-002427 Tocum, W. L. and F. J. Tesar. SLED FOR SAMPLING BENTHIC FISH LARVAE. *Prog. Fish-Cult.* 42(2):118-119. Apr. 1980. SFA 25(3)
[Great Lakes Res. Div., Univ. Mich., Ann Arbor 48109]

FERTILIZATION OF SOIL AND WATER

80-002428 Schroeder, G. L., J. J. Huddon, C. E. Wadewell and L. S. Pile. COMPARISON OF TWO METHODS OF USING LIQUID SWINE MANURE AS AN ORGANIC FERTILIZER IN THE PRODUCTION OF FILTER-FEEDING FISH. *Aquaculture* 20(2):147-159. June 1980. SFA 25(3)
[Natl. Fertilizer Cent., TVA, NFDC, Muscle Shoals, AL 35660]

80-002429 Burns, R. F. and S. O. Stickney. GROWTH OF TILAPIA *AUREA* IN PONDS RECEIVING POULTRY WASTES. *Aquaculture* 20(2):117-121. June 1980. SFA 25(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843] *Tilapia aurea* fry were stocked in five 0.05 ha ponds at 5000 fish/ha during June 1977. Four ponds received the wastes from 500, 1000, 2000 and 4000 laying hens/ha, respectively, while the fifth pond received no poultry wastes. After a 150-day growing period, final mean fish weights and average daily production paralleled the rates of organic fertilization. *T. aurea* averaged only 88 g in the pond which received no organic fertilization, but reached an average of 304 g in the pond fertilized by the wastes from 4000 hens/ha. Thus, *T. aurea* can be reared to market-size in ponds within a single growing season if sufficient levels of nutrient are available. Survival reached or exceeded 80% in all five ponds. Water quality remained within acceptable limits throughout the experiment. Although the effects of organic fertilization on water quality were apparent.

FERTILIZATION OF SOIL AND WATER (CONTINUED)

80-002430 Chattopadhyay, G. N. and L. N. Mandal. INORGANIC TRANSFORMATION OF APPLIED PHOSPHORUS IN BRACKISHWATER FISH POND SOIL UNDER DIFFERENT WATER SALINITY LEVELS. *Hydrobiologia* 71(1-2):125-130. 27 May 1980. SFA 25(3)
[Cent. Inland Fish. Res. Inst., Barrackpore, West Bengal, India] Transformation of applied phosphorus in a brackishwater fish pond soil was studied under different water salinity levels, as occurring in such ponds, in presence and in absence of added organic matter. Added phorphorus was found to disappear rapidly from the water phase with some variations under different water salinities. The amount of added phosphorus in saloid-bound form increased with increase in water salinity but the same in Bray's (No. 2) extractable form showed a reverse trend. Applied phosphorus was transformed mostly into insoluble calcium phosphate form which increased with increase in water salinity. Transformation was intermediate into iron phosphate and the least into aluminium phosphate form. Application of organic matter reduced the fixation of added phosphorus into the iron phosphate form during the initial period of study and thus increased availability of phosphorus both in water as well as soil phases.

80-002431 Musig, Y. and C. E. Boyd. COMPARISON OF POLYPHOSPHATE AND ORTHOPHOSPHATE AS FERTILIZERS FOR FISH PONDS. *Aquaculture* 20(2):135-138. June 1980. SFA 25(3)
[Dep. Fish., Sch. Agric., Auburn Univ., Auburn, AL 36830] Sodium polyphosphate and triple superphosphate were used as sources of polyphosphate and orthophosphate, respectively, at equal P_2O_5 application rates in sunfish (*Lepomis* spp.) ponds. Filtrable orthophosphate and total phosphorus concentrations were generally higher in ponds treated with polyphosphate. However, differences between chlorophyll *a* concentration and net sunfish production did not differ between treatments ($P > 0.05$).

80-002432 Stockner, J. G.; K. S. Shortreed and K. Stephens. THE BRITISH COLUMBIA LAKE FERTILIZATION PROGRAM: LIMNOLOGICAL RESULTS FROM THE FIRST 2 YEARS OF NUTRIENT ENRICHMENT. *Can. Dep. Fish. Oceans Tech. Rep.* No. 924. iv + 71p. Feb. 1980. In English with French summ. SFA 25(3)
[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC, Canada] Limnological studies were conducted on five sockeye salmon (*Oncorhynchus nerka*) nursery lakes and on one lake containing landlocked sockeye (kokanee) but no anadromous fish. The lakes were fertilized with ammonium phosphate and ammonium nitrate at levels up to 505 greater than calculated annual base loads. Annual primary production ranged from 16 to 150 gC/m^2, and all but Long Lake were classed as oligotrophic. The phytoplankton populations were dominated by diatoms; blue-green algae did not increase significantly with fertilization. Annual primary production and mean annual total chlorophyll in Kennedy Lake-Clayoquot Arm were 2 times higher in 1978 (fertilized) than in 1977 (unfertilized). Algal production and biomass in the remaining 5 lakes tended to be higher in the second year of fertilization (1978) than in the first (1977). Limnological conditions in all 5 lakes are discussed, where possible, with reference to higher trophic levels.

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

80-002433 Logan, B. E. and M. T. Masnik. IMPINGEMENT DYNAMICS AND AGE AND GROWTH OF SELECTED SPECIES AT LAKE DARDANELLE, A SOUTHCENTRAL RESERVOIR. *U.S. Nucl. Regul. Comm. Environ. Spec. Br. Tech. Rep.* NUREG-0601. vii + 54p. Oct. 1979. SFA 25(3)
[Environ. Spec. Br., P-234, Div. Site Safety & Environ. Anal., U.S. Nucl. Reg. Comm., Washington, D.C. 20555] Impingement data collected between 1974

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC. (CONTINUED)

80-002433 CONTINUED and 1979 was analyzed and compared with four years of data from Arkansas Nuclear One located on Lake Dardanelle, a southcentral run-of-the-river reservoir. *Dorosoma petenense*, *D. cepedianum*, *Ictalurus punctatus*, *Lepomis macrochirus*, and several other recreationally or ecologically important species commonly found on the intake screen were chosen for comparison. Weekly natural log transformed impingement estimates were plotted, and yearly impingement estimates were determined over the five year period. An analysis of variance on the transformed weekly estimates of eight species of fish indicated the significance ($F < .002$) of temperature on impingement for seven species. Yearly impingement of *D. petenense* was found to be correlated ($R^2 = .965$) with the average minimum water temperature of the reservoir. The lethal temperature threshold (as recorded at the intake) was determined to be between 3.3 and 5.5°C for *D. petenense* and 0.5 and 0°C for *D. cepedianum*. Results of the impingement analysis were compared and contrasted with age and growth studies in the reservoir.

80-002434 Moazzam, M. and S. H. N. Rizvi. FISH ENTRAPMENT IN THE SEAWATER INTAKE OF A POWER PLANT AT KARACHI COAST. *Environ. Biol. Fishes* 5(1):49-57. 30 Jan. 1980. SFA 25(3)
[Inst. Mar. Biol., Univ. Karachi, Karachi-32, Pakistan]

MATHEMATICS, STATISTICAL METHODS, AND MODELING

80-002435 Blinov, V. V.; Ye. A. Mitrofanov and V. V. Shevchenko. A STUDY OF THE RATIONAL EXPLOITATION OF A COMMERCIAL POPULATION OF THE NORTH SEA HADDOCK, *MELANOGRAMUS AEGLEFINUS*, BY MEANS OF A PRODUCTION MODEL. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(1):55-62. 1979. SFA 25(3)
[VNIRO, Moscow, USSR] For a calculation of the biomass of the North Sea haddock, *Melanogrammus aeglefinus*, the influence of exploitation rates and food consumption, Daan's bioproduction model is used, supplemented by experimental data on the feeding of the haddock.

80-002436 Cohen, M.-D. and G. S. Fishman. MODELING GROWTH-TIME AND WEIGHT-LENGTH RELATIONSHIPS IN A SINGLE YEAR-CLASS FISHERY WITH EXAMPLES FOR NORTH CAROLINA PINK AND BROWN SHRIMP. *Can. J. Fish. Aquatic Sci.* 37(6):1000-1011. June 1980. In English with French summ. SFA 25(3)
[Curric. Operations Res. Syst. Anal., Univ. N.C., Chapel Hill 27514]

80-002437 Deriso, R. B. HARVESTING STRATEGIES AND PARAMETER ESTIMATION FOR AN AGE-STRUCTURED MODEL. *Can. J. Fish. Aquatic Sci.* 37(2):268-282. Feb. 1980. In English with French summ. SFA 25(3)
[Curric. Mar. Sci., Univ. N.C., Chapel Hill 27514]

80-002438 McGaw, B. L. CONFIDENCE INTERVALS FOR OPTIMAL EFFORT ESTIMATES FROM THE SCHAEFER PRODUCTION MODEL. *Can. J. Fish. Aquatic Sci.* 37(2):208-209. Feb. 1980. In English with French summ. SFA 25(3)
[Dep. Econ., Univ. New Brunswick, Fredericton, NB E3B 5A3, Canada]

80-002439 Wlosinski, J. H. PREDICTABILITY OF STREAM ECOSYSTEM MODELS OF VARIOUS LEVELS OF RESOLUTION. *Ph.D. dissertation, Utah State Univ.* 149p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(11):5131. May 1980. SFA 25(3)

LAKE MANAGEMENT AND RESEARCH

80-002440 Healey, M. C. GROWTH AND RECRUITMENT IN EXPERIMENTALLY EXPLOITED LAKE WHITEFISH (*COREGONUS CLUPEAFORMIS*) POPULATIONS. *Can. J. Fish. Aquatic Sci.* 37(2):255-267. Feb. 1980. In English with French summ. SFA 25(3)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-002441 Swierzowska, L. CHANGES OF EEL EXPLOITATION IN POLISH LAKES. *Aquaculture* 20(1):71-75. May 1980. SFA 25(3)
[Inland Fish. Inst., Olsztyn, Poland] The paper discusses briefly eel exploitation and traditional methods of catching eel. Attention is drawn to changes taking place in eel exploitation in Polish lakes, and to their causes. Most effective methods of eel catching are reviewed. It is pointed out that utilization of active fishing gear, mainly seine nets and electric aggregates, creates significant possibilities of increasing eel catches. Eel yields up to 40 kg/ha are not unusual with this type of gear. Furthermore, active fishing gear is more effective and can be used also in lakes in which it is difficult to apply traditional eel traps. The latter fact is of special significance in view of the increasing number of lakes stocked with eel, and improvement of eel stocking effectiveness.

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-002442 Ellis, J. M.; G. B. Farabee and J. B. Reynolds. FISH COMMUNITIES IN THREE SUCCESSIONAL STAGES OF SIDE CHANNELS IN THE UPPER MISSISSIPPI RIVER. *Trans. Mo. Acad. Sci.* 13:5-20. 1979. SFA 25(3)
[Mo. Dep. Conserv., Kirksville 63501] During 1975-76, we compared the limnology and fish communities of three side channels of the Mississippi River in northeast Missouri: a riverine side channel (Buzzard Island), which had high flow rates, a sand-mud bottom and negligible thermal stratification; a lacustrine channel (Cottonwood Island), which had low flow rates, a mud-silt bottom, thermal stratification, and dissolved oxygen concentration as low as 1.0 mg/l during late summer; and a transitional side channel (Orton-Fabius Island), which was partly blocked with sediments, had intermediate physico-chemical characteristics, and was apparently changing from a riverine to a lacustrine habitat. Buzzard channel contained certain riverine species that Cottonwood channel apparently did not, and Cottonwood yielded certain lacustrine species not collected in Buzzard. Relative abundance of game and panfishes was lowest in Buzzard channel and highest in Cottonwood; the reverse was true of catfishes. Electrofishing, which yielded mainly panfishes, was probably the most reliable indicator of habitat changes resulting from side-channel succession; hoop netting for catfishes also provided reliable indications, but fewer species and numbers of fish were taken in relation to the effort expended. Artificial opening of transitional side channels may reduce losses of riverine side channels in the upper Mississippi River. Lack of mitigation will result in the continued loss of riverine habitat and its fish communities. Societal values must be employed in a choice between the maintenance of side channel habitat and its associated fishes, or the succession of channels to lacustrine habitat which temporarily supports different fishes before changing to permanent floodplain.

80-002443 Kuznetsov, V. A. and E. I. Fedayev. SOME FEATURES OF THE REPRODUCTION OF FISHES IN PARTS OF THE VOLGA BEFORE AND AFTER FLOW REGULATION. *J. Ichthyol.* (Engl. Transl. Vopr. Ikhtiol.) 19(1):81-90.

RIVER AND STREAM MANAGEMENT AND RESEARCH (CONTINUED)

80-002443 CONTINUED 1979. SFA 25(3)
[Dep. Vert. Zool., Kazan' Univ., USSR] The conditions, times, duration and success of reproduction of fish in the Volga around Koz'modem'yansk (in the zone of the former Cheboksary reservoir) and in the upper part of Kuybyshev reservoir were studied in years with similar flows. In years with a low spring runoff, spawning success is greater in the river than in the reservoir; in high-water years with a relatively stable water level in spring it may be higher in the reservoir than in the river. Differences were noted in the yield of young of different species depending on the spawning period.

80-002444 McNatt, R. M. FISH HABITAT LOSS IN THE SAN PEDRO RIVER, ARIZONA. *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:19-23. 30 Jan. 1980. In English with Spanish summ. SFA 25(3)
[U.S. FWS, Albuquerque, NM] The San Pedro River basin formerly consisted of a large perennial mainstream with associated springs and tributaries. Diversions, headwater impoundments, depletion of underground aquifers, clearing of riparian habitats, and a possible regional tendency toward increasing aridity have reduced mainstream surface flow to that of an intermittent stream, with perennial flow in 3 sections which comprise only 50 km of the total river length of 250 km. Aravaipa Creek, the largest tributary, presently contains 7 of the 13 native species reported from the basin, and is the only portion of the entire drainage that supports a relatively secure native fish fauna. Of the 7 species in Aravaipa Creek, 4 have not been found elsewhere in the basin since at least 1963.

80-002445 Winter, F. A. WHAT THE CIBOLA NATIONAL FOREST HAS DONE FOR THE ZUNI MOUNTAIN SUCKER, *PANTOSTEUS DISCOBOLUS YARROWI*. *Summ. Proc. Annu. Symp. Desert Counc.* 10:50. 30 Jan. 1980. Abstract only. SFA 25(3)
[Cibola Natl. For., Albuquerque, NM]

80-002446 Wydoski, R. S.; K. Gilbert; K. Seethaler; C. W. McAda and J. A. Wydoski. ANNOTATED BIBLIOGRAPHY FOR AQUATIC RESOURCE MANAGEMENT OF THE UPPER COLORADO RIVER ECOSYSTEM. *U.S. Fish Wildl. Serv. Resour. Publ.* 135. ii + 186p. 1980. SFA 25(3)

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

80-002447 LaBolle, L. D., Jr. A LIMNOLOGICAL STUDY OF THE WINTER CONDITIONS IN WINCHESTER LAKE, IDAHO. *Univ. Idaho For. Wildl. Range Exp. Stn. Curt Berklund Undergrad. Honor. Self-Initiated Res.* p. 5-16. 1979. Available from For. Wildl. Range Exp. Stn., Univ. Idaho, Moscow 83843. SFA 25(3)
Limnological conditions under winter ice were studied in Winchester Lake, a 38-ha impoundment located in Lewis County, Idaho. Dissolved oxygen concentrations were compared with the data collected on the temporal and spatial variation of the zooplankton, phytoplankton, and benthic macroinvertebrate populations. Invertebrate density and species composition expressed apparent positive correlations with variations in dissolved oxygen. Phytoplankton, however, showed no relationship. Through reflectance and absorptive mechanisms, the ice and snow cover caused up to a 99.8 percent reduction in the incident sunlight available for photosynthetic oxygen production. Hence, the dissolved oxygen concentration in the water was inversely related to the depth of the ice and snow cover. Dissolved oxygen analysis revealed that only 10.1 percent of the lake volume provided suitable conditions for the support of viable trout populations during the winter

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

80-002447 CONTINUED months. Although limited photosynthetic oxygen production did occur, inflows of oxygenated water were important in providing adequate oxygen levels for the overwintering trout populations during periods of continuous ice and snow cover.

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH

80-002448 Hoffman, R. DOCTORING BIG MAC. *Nebraskaland* 58(5):16-17, 43-44, 46. May 1980. SFA 25(3)

80-002449 Holden, P. B. WILL OUTLET MODIFICATION OF FLAMING GORGE DAM HELP THE COLORADO SQUAWFISH? *Summ. Proc. Annu. Symp. Desert Fish. Counc.* 10:37. 30 Jan. 1980. Abstract only. SFA 25(3)

[BIO/WEST, Inc., Logan, UT] Flaming Gorge Dam was closed in 1962 and in the following 4-5 years an excellent tailwater trout fishery was established. During this same period, Colorado squawfish were eliminated for 65 miles below the dam, to the mouth of the Yampa River. Below this point, squawfish were fairly common and reproduced successfully. The tailwater trout fishery started to decline in 1968-69, at the same time that Colorado squawfish reproduction stopped in the Green River in Dinosaur National Monument. Cold tailwater temperatures were blamed for both declines. An analysis of temperature and flow data from the Green River indicated that tailwater temperatures were reduced more due to high flows than actual release temperatures. The Bureau of Reclamation installed outlet modifications in 1978 to warm the tailwater temperatures and, hopefully, improve the trout fishery. BIO/WEST is conducting a study below the trout habitat portion to determine effects of the modifications on distribution and reproduction of warm water fishes. The study is designed to last 3 years and compare pre- and post-modification conditions. Data collected to date suggests native species will successfully reproduce in portions of the river previously too cold for reproduction.

MARINE MANAGEMENT AND RESEARCH

80-002450 Anderson, E. D.; F. E. Lux and F. P. Almeida. THE SILVER HAKE STOCKS AND FISHERY OFF THE NORTHEASTERN UNITED STATES. *Mar. Fish. Rev.* 42(1):12-20. Jan. 1980. SFA 25(3)

[NMFS, Woods Hole, MA 02543]

80-002451 Giddings, G. G. SOUTH AMERICAN HAKES: THE RESOURCE AND ITS UTILIZATION. *Mar. Fish. Rev.* 42(1):8-11. Jan. 1980. SFA 25(3)

[Fund. Chile, Casilla 773, Avda. Santa Maria 06500, Santiago, Chile]

80-002452 Grant, C. J.; R. L. Sandland and A. M. Olsen. ESTIMATION OF GROWTH, MORTALITY AND YIELD PER RECUIRT OF THE AUSTRALIAN SCHOOL SHARK, *GALEORHINUS AUSTRALIS* (MACLEAY), FROM TAG RECOVERIES. *Aust. J. Mar. Freshwater Res.* 30(5):625-637. Oct. 1979. SFA 25(3)

[Zool. Dep., Univ. West Indies, Mona, Kingston 7, Jamaica] A study of growth, mortality and yield per recruit of *G. australis* in south-eastern Australia has been undertaken. The species is long-lived, slow growing and has a low natural mortality rate. The fishery in Victoria was recently adversely affected by the imposition in 1972 of an upper size limit of 104

MARINE MANAGEMENT AND RESEARCH (CONTINUED)

80-002452 CONTINUED cm, in addition to an existing legal minimum length of 91 cm, to ensure that sharks with flesh mercury levels in excess of 0.5 µg/g were not taken for human consumption. More recent (1976) legislation altered these limits to a minimum length of 71 cm and a maximum length of 112 cm. This paper discusses the possible effects of increased exploitation within the length limitations which are currently operative on the availability of breeding stock of the school shark.

80-002453 Wine, V. L. PRELIMINARY REPORT ON THE ABILITY OF MARINE RECREATIONAL FISHERMEN TO IDENTIFY THE MORE COMMONLY CAUGHT SPORTFISH. *Calif. Dep. Fish Game Mar. Resour. Admin. Rep.* No. 79-14. 28p. Dec. 1979. SFA 25(2)
[Calif. State Fish. Lab., 350 Golden Shore, Long Beach 90802] Fishermen on piers and privately-owned boats in southern California were surveyed to determine their ability to identify (by common name) 18 of the more commonly caught sportfish. Anglers were shown color photographs of the fish and asked to identify them. Most people were not able to identify more than 5 or 6 species correctly. The number of incorrect responses (calling one species by another's name, or using a non-recommended common name) was not high. Instead, it was the level of non-response (the fisherman had no idea what the species was) that was surprisingly high. The results of the survey indicate that anglers are not familiar with the names of the fish they are most likely to catch. This has serious implications concerning our fishery management programs which depend on anglers' compliance with fishing regulations. The effectiveness of the programs depends in part on anglers being able to recognize regulated species when encountered.

UTILIZATION OF FISHERY PRODUCTS

80-002454 FAO of the UN. 1978 YEARBOOK OF FISHERY STATISTICS. FISHERY COMMODITIES. *FAO Fish. Ser.* 11:xvi + 279p. 1979. SFA 25(3)
[Rome, Italy]

80-002455 McMillan, A. D. ARCHAEOLOGICAL EVIDENCE FOR ABORIGINAL TUNA FISHING ON WESTERN VANCOUVER ISLAND. *Syesis* 12:117-119. 1979. SFA 25(3)
[Douglas Coll., New Westminster, BC V3L 5B2, Canada]

80-002456 Whitaker, D. R. WORLD UTILIZATION OF HAKE. *Mar. Fish. Rev.* 42(1):4-7. Jan. 1980. SFA 25(3)
[NMFS, Washington, DC 20235]

MISC. TECHNIQUES AND EQUIPMENT

80-002457 Holanov, S. H. SENSITIVE LIGHT METER FOR FISH BEHAVIOR STUDIES. *Prog. Fish-Cult.* 42(2):120-122. Apr. 1980. SFA 25(3)
[Sch. Renewable Nat. Resour., Univ. Ariz., Tucson 85721]

80-002458 Manne, R. E., Jr. and B. G. Whiteside. INACCURACY OF SEX DETERMINATION IN GUADALUPE AND LARGEMOUTH BASS ON THE BASIS OF EXTERNAL CHARACTERISTICS. *Prog. Fish-Cult.* 42(2):116-117. Apr. 1980. SFA 25(3)
[Aquatic Stn., Southwest Tex. State Univ., San Marcos 78666]

MISC. TECHNIQUES AND EQUIPMENT (CONTINUED)

80-002459 Platts, W. S. and V. E. Penton. A NEW FREEZING TECHNIQUE FOR SAMPLING SALMONID REDDS. *U.S. For. Serv. Res. Rep.* INT-248. 22p. 1980. SFA 25(3)

[U.S. For. Serv., 316 E. Myrtle St., Boise, ID 83706] This report describes a new multiprobe freeze method for determining salmonid redd sediment particle size distribution. This method will collect salmonid eggs and alevins in the redd at any stage of development, any air or water temperature, any stream depth, and determine their horizontal and vertical location. This method allows larger size samples to be collected which can help improve our understanding of embryo and alevin survival rates and causes of their mortality. This substrate freeze method differs from the past freeze methods that expanded CO_2 liquid to atmospheric pressure. This method expands CO_2 to a pressure of 78 psia (a boiling liquid - gas medium) which provides a higher heat transfer because of the better control of gas use, higher cooling efficiency, and fewer clogging problems. A field test is described where the ratio of CO_2 consumed to redd materials lifted was 0.34 lb CO_2 per 1 lb of redd material. A complete step-by-step description of the methodology is given with a listing of parts, materials, and suppliers.

80-002460 Whitworth, W. R. and R. E. Schmidt. SNORKELING AS A MEANS OF EVALUATING FISH POPULATIONS IN STREAMS. *N.Y. Fish Game J.* 27(1):91-94. Jan. 1980. SFA 25(3)

[Dep. Fish., Univ. Conn., Storrs]

REVIEWS, BIBLIOGRAPHIES, ETC.

80-002461 Cleugh, T. R. and L. R. Russell. FISHERIES AND FISH RELATED PUBLICATIONS IN THE YUKON TERRITORY. *Can. Dep. Fish. Oceans Tech. Rep.* No. 938. Apr. 1980. In English with French summ. SFA 25(3)

[Dep. Fish. Oceans, 1090 West Pender St., Vancouver, BC V6E 2P1, Canada]

SPORT FISHING-TECHNIQUES, ETC.

80-002462 O'Grady, K. T. and P. C. R. Hughes. FACTORIAL ANALYSIS OF AN EXPERIMENTAL COMPARISON OF THREE METHODS OF FISHING FOR RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON, IN STILL WATER. *J. Fish Biol.* 16(3):257-264. Mar. 1980. SFA 25(3)

[Dep. Biol. Sci., City London Polytech., Old Castle St., London E1 7NT, England] A three day experiment compared angling returns for rainbow trout, *Salmo gairdneri* Richardson, using fly, spinner and worm fishing methods. The catches of these methods were most similar on the first day: 3.36/h, 2.61/h and 3.75/h for spinner, fly and worm fishing, respectively. Catch rates on subsequent days declined, but less so for worm fishing. Overall, the worm fishing method returned the highest catch rate and estimates of catch rates for a year on a trout fishery also indicated that this method returned the highest catch rate.

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Alaska: Wood River Lakes
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Antarctic
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Arabian Sea
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Arizona: Aravaipa Creek
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Arizona: Graham Cty.: Aravaipa Creek
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Arizona: Rio Yaqui
80-002208
Arizona: San Pedro River
80-002444
Arkansas: Bayou DeView
80-002397
Arkansas: Benton Cty.: Crystal Lake
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Arkansas: Cache River
80-002397
Arkansas: Lake Dardanelle
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Arkansas: Ten Mile Creek
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Atlantic Ocean
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Atlantic Ocean, North
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Atlantic Ocean, North: South Atlantic Bight
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Atlantic Ocean, South
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Atlantic Ocean: New York
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Australia
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80-001937
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Australia: Queensland: Serpentina Creek
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California
80-002162
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California: Lake Greenhaven
80-002240
California: Los Angeles
80-002173
California: Modoc Cty.: Cowhead Lake
80-002242
California: Mono Cty: Little Walker River
80-002158
California: Monterey Bay
80-002099
80-002163
California: Newport Bay
80-002111
California: Pit River
80-001870
California: Sacramento River
80-002349
California: Sacramento-San Joaquin Estuary
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California: Salton Sea
80-002233
California: Santa Barbara
80-002206
California: Shasta Lake
80-002120
Cameroon: River Mungo
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Canada: Alberta
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Canada: British Columbia
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Canada: British Columbia: Vancouver Island
80-002455
Canada: Hudson Bay
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Canada: James Bay
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Canada: Manitoba
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Canada: New Brunswick
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Canada: New Brunswick: Saint John River
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Canada: Northwest Territories
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Canada: Ontario
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Canada: Prince Edward Island: North Brook
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Canada: Quebec
80-002167
Canada: Quebec: Caniapiscau River
80-002117
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80-002421
Canada: Quebec: Lac Vert
80-002178
Canada: Yukon
80-002461
Caribbean Sea
80-002200

Celtic Sea
80-002151
Chesapeake Bay
80-002321
Chile
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Colorado River
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Colorado: Colorado River
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Colorado: Green River
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Czechoslovakia
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Czechoslovakia: Rokytna River
80-002166
Delaware River
80-002327
England: Windermere
80-002112
80-002181
Finland: Lake Paijanne
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Florida
80-002063
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Florida: Lake Wales
80-002191
Georgia: Carroll Cty.: Dog River
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Georgia: Lake Carroll
80-002300
Georgia: Roaring Branch Creek
80-002402
Georgia: Savannah River
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80-002399
Gulf of Aqaba
80-002223
Idaho: Lewis Cty.: Winchester Lake
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Illinois
80-002295
80-002334
Illinois: Fox River
80-002338
Illinois: Kane Cty.: Elgin: Trout Park Nat. Preserve
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India
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Indian Ocean
80-002100
80-002225
Indiana
80-002329
Indiana: Palestine Lake
80-002323
Indiana: Spring Mill State Park
80-002308
Iowa
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Iowa: Des Moines River
80-002325
Iran
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Italy
80-001838
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Japan
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Kenya: Lake Kamburu
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Lake Michigan
80-002052
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Lake Ontario
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Maine: Penobscot River
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Malawi: Lake Malawi
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Massachusetts: Connecticut River
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Mediterranean Sea
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Mexico: Nuevo León: El Potosi
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Mexico: Rio Mayo
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Mexico: Rio Yaqui
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Mexico: Vera Cruz
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Michigan: Barry Cty.: Long Lake
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Minnesota: Voyageurs Natl. Park
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Mississippi River
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Missouri
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Missouri River
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Missouri: Mississippi River
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Montana
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Montana, Southeastern
80-002203
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SPORT FISHERY ABSTRACTS

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GENERAL FISH CULTURE

80-002463 Jeffries, E. R. PROCEEDINGS OF THE THIRTHIETH ANNUAL NORTHWEST FISH CULTURE CONFERENCE. *Proc. Annu. Northwest Fish Cult. Conf.* 30:1-154. Dec. 1979 (1980). SFA 25(4)

A collection of unedited briefs or oral reports presented at the conference.

80-002464 Kutty, M. N. AQUACULTURE IN SOUTH EAST ASIA: SOME POINTS OF EMPHASIS. *Aquaculture* 20(3):159-168. July 1980. SFA 25(4)

[Fish. Coll., Tamil Nadu Agric. Univ., Tuticorin-628003, India]

TROUT AND SALMON CULTURE

80-002465 Fagerlund, U. H. M.; D. A. Higgs; J. R. McBride; M. D. Plotnikoff and B. S. Dosanjh. THE POTENTIAL FOR USING THE ANABOLIC HORMONES 17α-METHYLTESTOSTERONE AND (OR) 3,5,3'-TRIIODO-*L*-THYRONINE IN THE FRESH WATER REARING OF COHO SALMON (*ONCORHYNCHUS KISUTCH*) AND THE EFFECTS ON SUBSEQUENT SEAWATER PERFORMANCE. *Can. J. Zool.* 58(8):1424-1432. Aug. 1980. In English with French summ. SFA 25(4)

[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Juvenile coho salmon (*Oncorhynchus kisutch*) held in 11°C fresh water (FW) were fed Oregon moist pellets supplemented with 3,5,3'-triiodo-*L*-thyronine at 4 ppm (T_3^4) or 20 ppm (T_3^{20}) and (or) 17α-methyltestosterone at 0.2 ppm ($MT^{0.2}$) or 1 ppm (MT^1) until early or normal seawater (SW) transfer. During FW residency all hormonal treatments improved growth, appetite, and food utilization. In February, fish fed T_3^{20} singly or with MT had increased degranulation of somatotrop cytoplasm. Thyroid epithelial cell height of fish fed T_3^4 or T_3^{20} was either suppressed or enhanced. MT^1 singly or combined with T_3 induced androgenic side effects in males. Proximate body composition was affected only by MT. T_3^{20} induced morphological anomalies and treatment was discontinued. In May, thyroid activity and number of putative gonadotrops of fish fed MT^1 were increased. Androgenic effects of all groups given MT^1 were greater in May than in February. After SW transfer in February growth, appetite, and food utilization were depressed but fish fed T_3^4 performed better than controls. Performance of all groups improved after May but, in general, mortality increased slightly. After transfer in May, T_3-fed fish had increased growth in length. It is concluded that MT and T_3 effectively enhance growth in FW but only T_3 facilitates SW transfer.

80-002466 Ghittino, P. MORTALITA' DA CAUSE NON IDENTIFICABILI IN TROTICOLTURA E SUA INCIDENZA PERCENTUALE. [MORTALITY (IN PERCENT) BY UNIDENTIFIED FACTORS IN FISH FARMING.] *Riv. It. Piscic. Ittiop.* 15(2):33-35. Apr.-May-June 1980. In Italian with English summ. SFA 25(4)

[Ist. Zooprof. Sper., Via Bologna, 148-10154 Torino, Italy] In fish farming, in spite of the propress in scientifical knowledges recently achieved, it's still necessary to consider mortalities deriving from unidentified factors (alias, «natural mortalities»). The author shortly reviewed such mortalies in order to provide an useful guideline for

TROUT AND SALMON CULTURE (CONTINUED)

80-002466 CONTINUED quantifying productions in trout farming and also to suggest criteria to apply in establishing fiscal parameters for that zootechnical venture. Basing on bibliographic data and on data emerging from a preliminary survey performed in some Italian commercial trout farms, it appears as advisable to consider that natural losses amount (roughly) to 15% in brood trout, to 25% in trout eggs, to 30% until fingerling stage, and to 30% before harvesting. Practically, it can be presumed that, by starting from trout eggs, only a 25% of egg number will reach salable trout.

80-002467 Halverson, C. J.; J. W. Jensen and C. E. Boyd. WATER QUALITY IN STANDING-WATER PONDS FOR WINTER PRODUCTION OF RAINBOW TROUT IN ALABAMA. *Trans. Am. Fish. Soc.* 109(3):310-313. May 1980. SFA 25(4)
[Fish Breeders, P.O. Box 448, Niland, CA 92257]

80-002468 Haywood, G. P.; J. R. Brett and J. M. Blackburn. ACCUMULATION OF EXCRETORY PRODUCTS AND EFFECT ON GROWTH OF YEARLING COHO SALMON (*ONCORHYNCHUS KISUTCH*) IN GRADUALLY INCREASING RECIRCULATED WATER. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 946. iv + 17p. June 1980. In English with French summ. SFA 25(4)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Coho salmon, averaging 97 g initial weight, were subjected to recycling of reaerated water (15 °C) at an increasing proportion, starting at 50% recirculation and continuing to a final 100% for a brief period. Total ammonia, unionized ammonia, urea, pH and oxygen were monitored throughout the 237-day experiment. A difference in growth rate between test fish and controls was apparent towards the end of the 80% recirculation period. An average decrease of 15% in weight occurred at this and higher levels of staged recirculation. During the 95% recirculation period (31 days), at a fish density of 25 lb/gpm, total ammonia reached 2.6 ppm, unionized ammonia was 3.6 ppb at a pH of 6.5, urea was 0.7 ppm, and O_2-concentration averaged 5.8 ppm. The final levels of these environmental parameters during 12 days of 100% recirculation were: 3.3 ppm total ammonia, 4.7 ppb unionized ammonia, 0.5 ppm urea, 6.5 pH and 4.5 ppm O_2. Nitrite poisoning was observed during the last stage, causing some mortalities; a single measurement revealed a level of 3.5 ppm nitrite at termination of the test. It is concluded that up to 70% recirculation with reaeration did not generate sufficient environmental degradation from excretory products to induce a significant decrease in growth rate of yearling coho salmon under the conditions and duration imposed.

80-002469 Hiroi, O. [ON THE WATER-WASHING TIME OF CHUM SALMON EGGS SOON AFTER THE ARTIFICIAL FERTILIZATION.] *Sci. Rep. Hokkaido Salmon Hatchery* No. 34. p. 115-120. Mar. 1980. In Japanese with English summ. SFA 25(4)
[Hokkaido Salmon Hatchery, Fish. Agency, 2-2 Nakknoshima, Toyohiruku, Sapporo, Hokkaido, Japan 062]

80-002470 Hosmer, M. J. HANDLING AS A FACTOR IN MORTALITY OF TROUT WITH OR WITHOUT FURUNCULOSIS. *Prog. Fish-Cult.* 42(3):157-159. July 1980. SFA 25(4)
[U.S. FWS, Natl. Fish. Cent., Kearneysville, WV 25430]

80-002471 Lagasse, J. P.; D. A. Leith; D. B. Romey and O. F. Dahrens. STAMINA AND SURVIVAL OF COHO SALMON REARED IN RECTANGULAR CIRCULATING PONDS AND CONVENTIONAL RACEWAYS. *Prog. Fish-Cult.* 42(3):153-156. July 1980. SFA 25(4)
[Oreg. Dep. Fish Wildl., Sandy Lab., 39800 SE Fish Hatchery Rd., Sandy 97055]

TROUT AND SALMON CULTURE (CONTINUED)

80-002472 Magomedov, G. M.; G. K. Azhigaliyeva and S. N. Popovichenko. FIRST RESULTS OF THE USE OF THE CHALNIK EGG INCUBATOR FOR THE INTRODUCITON OF AUTUMN CHUM SALMON, *ONCORHYNCHUS KETA*, INTO THE CASPIAN SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikthiol.)* 19(3):167-171. 1979. SFA 25(4)
[Dagestan Dep., Caspian Fish. Res. Inst., Makhachkala, USSR]

80-002473 Mandis, T. ALTERATION OF PHOTOPERIODS TO INDUCE EARLY SPAWNING IN RAINBOW TROUT. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:24-27. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
Fish management objectives in Colorado require that certain sizes and numbers of trout be available throughout the year. With normal spawning taking place from October to January, however, these objectives are usually very difficult to meet. The spawning period for hatchery rainbow trout (*Salmo gairdneri*) is affected by many factors--waters, temperature, genetics, photoperiod, etc. Research in environment and genetics will continue to play an important part in the propagation of salmonids. However, the potential for varying the length of the spawning time by controlling photoperiods is the most promising technique for the immediate future.

80-002474 Werder, U. LABORATORY INCUBATION SYSTEM FOR SALMONID EGGS. *Prog. Fish-Cult.* 42(3):190-191. July 1980. SFA 25(4)
[Inst. Nac. Pesq. Amazonia, Caixa Post. 478, Dep. Fish Cult., 69.000 Manaus-AM, Brasil]

WARMWATER CULTURE

80-002475 Ang Kok Jee. SOME PROBLEMS IN THE CAGE CULTURE OF MARBLE GOBY (*OXYELEOTRIS MARMORATA* BLEEKER). *Aquaculture* 20(3):229. July 1980. Abstract only. SFA 25(4)
[Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia] The cage culture project for marble goby (*Oxyeleotris marmorata* Bleeker) was initiated at the Universiti Pertanian Malaysia Fish Pond Complex in April 1978. The fish were stocked in floating net cages at four stockings rates: 30, 50, 70, and 90 fish/cage. Each net cage measured 2 m X 1.5 m X 1m. The net was of nylon material of 1.8 cm mesh size. The first trial was terminated in June 1978 due to high mortality caused by a protozoan parasite, *Trichodina* sp. Several problems were faced in culturing this fish in the University Pond Complex. One of them was the difficulty in obtaining fish seed of the right size for the trial. There were some predators such as *Channa striata* and water snake which caused some mortality to the fish and damage to the cage nets. Though fouling was not a serious problem, silt deposition and algal growth on the net might cause some problems if no regular cleaning is done. Preparations are now under way to produce enough seeds for the next trial.

80-002476 Cruz, E. M. and I. L. Laudencia. POLYCULTURE OF MILKFISH (*CHANOS CHANOS* FORSKAL), ALL-MALE NILE TILAPIA (*TILAPIA NILOTICA*) AND SNAKEHEAD (*OPHICEPHALUS STRIATUS*) IN FRESHWATER PONDS WITH SUPPLEMENTAL FEEDING. *Aquaculture* 20(3):231-237. July 1980. SFA 25(4)
[Freshwater Aquacult. Cent., Cent. Luzon State Univ., Nueva Ecija, Philippines] Results showed that all-male Nile tilapia can be cultured in milkfish ponds without affecting the growth and production of milkfish, at ratios of 1-3 tilapia to 5 milkfish; 2:5 is the optimum ratio. Supplemental feeding with fine rice bran or copra meal at a daily rate of 5% of the biomass increased the net production of milkfish but had no influence on all-male Nile tilapia. Standing crop of about 890 kg/ha in 135 days was obtained in a polyculture system of milkfish, all-male Nile tilapia and snakehead when fed rice bran.

WARMWATER CULTURE (CONTINUED)

80-002477 Curry, K. D. and A. Spacie. TEMPERATURE-CONTROLLED RECIRCULATING SYSTEM FOR HATCHING CATOSTOMID LARVAE. *Prog. Fish-Cult.* 42(3):151-152. July 1980. SFA 25(4)
[Dep. For. Nat. Resour., Purdue Univ., West Lafayette, IN 47907]

80-002478 Detlaf, T. A. and S. I. Davydova. THE EFFECT OF TRIIODOTHYRONINE ON THE MATURATION OF THE OOCYTES OF THE SEVRYUGA, *ACIPENSER STELLATUS*, UNDER THE INFLUENCE OF THE GONADOTROPIC HORMONES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):105-110. 1979. SFA 25(4)
[N. K. Kol'tsov Inst. Dev. Biol., USSR Acad. Sci., Moscow, USSR]

80-002479 Hogendoorn, H. and M. M. Vismans. CONTROLLED PROPAGATION OF THE AFRICAN CATFISH, *CLARIAS LAZERA* (C. & V.). II. ARTIFICIAL REPRODUCTION. *Aquaculture* 21(1):39-53. Sept. 1980. SFA 25(4)
[Dep. Fish Cult. Inland Fish., Agric. Univ., P.O. Box 338, Wageningen, The Netherlands] To optimize the artificial reproduction of *C. lazera* for aquaculture, experiments were carried out on short-term sperm conservation as well as hypophysation and stripping of the females. When the sperms were stored at 5°C for 24 h, their fertilizing capability was reduced by 4% compared with freshly obtained sperm. However, dilution in a 0.9% NaCl solution (up to $1/10^3$) gave an average 9% increase of hatching success. This finding enables the use of one competent male to fertilize the eggs of many females. An alternative application of the finding enables homoplastic hypophysation, using the fresh pituitary of the male to induce ripening of the female, while the sperms are stored for later use. Correct timing of stripping of the females in relation to hypophysation proved to be critical for obtaining good hatching results. This was increasingly so when temperatures were high. The best results in these experiments were obtained when stripping took place 21, 11 or 7 h after hypophysation at 20, 25 and 30°C, respectively. At this time the eggs were flat, with the cytoplasm concentrated at the animal pole as a reddish-brown spherical cap. The incubation period of the eggs decreased with increasing temperature. In all instances a large proportion of deformed fry occurred which was inversely related to the hatching percentage. Incubation without a regular water exchange gave 4% more hatching, 6% less deformation and a shorter incubation period than incubation with water exchange. Hypophysation was repeated four times with 1-, 2- or 3-week intervals and resulted in successful stripping, fertilization and hatching of the eggs after each hypophysation.

80-002480 Hollerman, W. D. and C. E. Boyd. NIGHTLY AERATION TO INCREASE PRODUCTION OF CHANNEL CATFISH. *Trans. Am. Fish. Soc.* 109(4):446-452. July 1980. SFA 25(4)
[Dep. Fish. Allied Aquacult., Auburn Univ. Agric. Exp. Stn., Auburn, AL 36830]

80-002481 Matsuno, T.; M. Katsuyama; M. Iwahashi; T. Koike and M. Okada. INTENSIFICATION OF COLOR OF RED *TILAPIA* WITH LUTEIN, RHODOXANTHIN AND SPIRULINA. *Bull. Jpn. Soc. Sci. Fish.* 46(4):479-482. Apr. 1980. WR 179
[Kyoto Coll. Pharm., Misasagi, Yamashina-ku, Kyoto 607, Japan]

80-002482 McGinty, A. S. SURVIVAL, GROWTH AND VARIATION IN GROWTH OF CHANNEL CATFISH FRY AND FINGERLINGS. *Ph.D. dissertation, Auburn Univ.* 74p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(1):5. July 1980. SFA 25(4)
Effects of insect control and stocking density on survival and growth of channel catfish fry were studied in 9 ponds (0.04-ha) stocked with 2,000, 8,000 or 14,000 fry. Prior to stocking, one pond per density was treated with

WARMWATER CULTURE (CONTINUED)

80-002482 CONTINUED either methyl parathion, Dylox or diesel fuel to control aquatic insects. Zooplankton abundance was determined before and after stocking. Fry survival at low, medium and high stocking densities was 79, 94 and 98% for methyl parathion; 93, 83 and < 1% for Dylox; and 0, 0 and 0% for diesel fuel treated ponds, respectively. Predation by odonate nymphs was responsible for no survival in ponds treated with diesel fuel. Fry survival increased as zooplankton abundance increased. As harvest number increased, standing crop increased while mean length and weight decreased. Fry were more uniform in length from ponds with low and medium densities than high densities. Effects of food particle size on lengths of channel catfish fry were studied in hapas and troughs. Fry were fed either a 2 to 3 mm diameter pellet or a finely ground meal. Fry in 3 hapas received no supplemental food. Fry mortality was high in all hapas and fry fed meal or not fed were shorter and more variable than fry fed pellets. Meal apparently passed though the hapas and was not available for consumption. In troughs, survival was greater for fry fed meal than those fed pellets. There was no differences in uniformity between treatments. Fry fed pellets were more positively skewed than fry fed meal. Effects of stocking density and feeding rate on growth of channel catfish fingerlings were studied in ponds and troughs. In 8 ponds, 3,400 fingerlings/pond were fed either 0.5 or 5.0% total body weight daily. Twelve troughs were stocked with either 30 or 250 fingerlings/trough and fed either 1 or 5% total body weight daily. Fingerlings fed a high rate or cultured at low densities increased in length and weight faster than those fed at a low rate or cultured at low densities. Variation in length increased as mean length increased regardless of feeding rate or stocking density. Lengths of fish fed at low rates were more positively skewed than fish fed high rates. There was no difference in skewness between lengths of fish stocked at low and high densities. In conclusion, increasing consumption by feeding rations of unsuitable size for consumption by all individuals or by feeding insufficient quantities of food did not affect the uniformity of the population but did result in a few individuals of larger size causing length distributions to be more positively skewed.

80-002483 Ogurtsov, G. I. ECOLOGICAL SIGNIFICANCE OF THE WINTER BEDDING OF CARP FINGERLINGS. *Sov. J. Ecol. (Engl. Transl. Ekologiya)* 10(5):441-443. May 1980. SFA 25(4)

80-002484 Rifai, S. A. CONTROL OF REPRODUCTION OF *TILAPIA NILOTICA* USING CAGE CULTURE. *Aquaculture* 20(3):177-185. July 1980. SFA 25(4)

[Fac. Agric., Panjadjaran Univ., Bandung, Indonesia] Experiments were conducted to control reproduction of *Tilapia nilotica* using cage culture compared with growth and reproduciton in ponds. Three rearing densities (5, 15, and 45 fish percage), and three kinds of aquatic plant (*Hydrilla* sp., *Lemna* sp., and *Chara* sp.) were used as feed. Results of the study showed that *Tilapia* reproduced in both cages and ponds; however, the intensity of reproduction was low. Growth rates of fish reared in cages were higher than those of fish reared in ponds. *Lemna* sp. as feed gave the best results in terms of growth rate and protein content of fish flesh. There was no interaction between feed and rearing density.

80-002485 Sinha, V. R. P. HYDRATION OF FEMALE SPAWNERS OF CARPS DURING HYPOPHYSATION. *Hydrobiologia* 72(1-2):193-196. 10 July 1980. SFA 25(4)

[Freshwater Aquacult. Res. Training Cent., 624 Saheed Nagar, Bhubaneswar 751007, India] Those female major carps which gained weight after injection of pituitary extract to induce spawning, ovulated more successfully than those which did not. In practice, therefore, fishes which lose weight up to the second of the two injections customarily given, may not be injected further. The gain in weight is caused by induced hydration of the spawner.

WARMWATER CULTURE (CONTINUED)

80-002486 Tan, E. S. P. SOME ASPECTS OF THE BIOLOGY OF MALAYSIAN RIVERINE CYPRINIDS. *Aquaculture* 20(3):281-289. July 1980. SFA 25(4)
[Sch. Biol. Sci., Univ. Sains Malaysia, Penang, Malaysia] Four indigenous riverine carps, namely *Leptobarbus hoeveni*, *Tor tambroides*, *Puntius daruphani* and *Puntius bulu*, currently command a good market price in Malaysia. The potential of these species for culture was assessed by both field and experimental studies. Basic information essential for future breeding programmes of these species was obtained. The findings suggest that some of these species could prove to be useful new species for future aquaculture programmes.

MARICULTURE

80-002487 Chua, T. E. and S. K. Teng. ECONOMIC PRODUCTION OF ESTUARY GROUPER, *EPINEPHELUS SALMOIDES* MAXWELL, REARED IN FLOATING NET CAGES. *Aquaculture* 20(3):187-228. July 1980. SFA 25(4)
[Sch. Biol. Sci., Univ. Sains Malaysia, Penang, Malaysia]

80-002488 Smith, T. I. J.; E. K. Dingley and D. E. Marchette. INDUCED SPAWNING AND CULTURE OF ATLANTIC STURGEON. *Prog. Fish-Cult.* 42(3):147-151. July 1980. SFA 25(4)
[S.C. Mar. Resour. Res. Inst., P.O. Box 12559, Charleston 29412]

FEEDS, FEEDING, AND NUTRITION

80-002489 Beck, A. D. and H. A. Poston. EFFECTS OF DIET ON SURVIVAL AND GROWTH OF THE ATLANTIC SILVERSIDE. *Prog. Fish-Cult.* 42(3):138-143. July 1980. SFA 25(4)
[U.S. Environ. Prot. Agency, Narragansett, RI 02882]

80-002490 Biette, R. M. and G. H. Geen. THE FATE OF ^{14}C LABELED FOOD INGESTED BY UNDERYEARLING SOCKEYE SALMON, *ONCORHYNCHUS NERKA*, IN RELATION TO TEMPERATURE AND RATION. *Can. J. Fish. Aquatic Sci.* 37(7):1184-1192. July 1980. SFA 25(4)
[Fish. Br., Ontario Minist. Nat. Resour., Queen's Park, Toronto, ON M7A 1W3, Canada]

80-002491 Bowen, S. H. NON-PROTEIN DETRITAL AMINO ACIDS ARE THE KEY TO RAPID GROWTH OF TILAPIA (PISCES, CICHLIDAE) IN LAKE VALENCIA, VENEZUELA. *Bull. Ecol. Soc. Am.* 61(2):151-152. June 1980. Abstract only. SFA 25(4)
[Mich. Technol. Univ., Houghton] Amino acids in the diet of the detritivorous cichlid fish *Sarotherodon massambicus* are present in both protein and non-protein forms. Most proteins appear to be constituants of living microbes while non-protein amino acids appear to be constituants of detritus. *S. mossambicus* possess special adaptations for digestion of both amino acid sources. In Lake Valencia, *S. mossambicus* achieves, rapid growth on a low protein diet by selective grazing on detritus with a high total amino acid content.

80-002492 Castel, J. D. and K. Tiews. REPORT OF THE EIFAC, IUNS AND ICES WORKING GROUP ON STANDARDIZATION OF METHODOLOGY IN FISH NUTRITION RESEARCH. *EIFAC (Eur. Inland Fish. Advis. Comm.) Tech. Pap.* No. 36. v + 24p. 1980.

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

80-002492 CONTINUED SFA 25(4)
[Dep. Fish. Oceans, P.O. Box 550, Halifax, NS B3J 2S7, Canada]

80-002493 Dahlgren, B. T. THE INFLUENCE OF THREE DIETARY NON-PROTEIN LEVELS ON FECUNDITY AND FERTILITY IN THE GUPPY *POECILIA RETICULATA*. *Oikos* 34(3):337-346. May 1980. In English with Russian summ. SFA 25(4)

Feeding experiments were carried out to examine the effects of different amounts of dietary non-protein (carbohydrates and lipids) on fecundity and fertility in the guppy, *Poecilia reticulata* (Peters). There were no significant differences in total body length between females given different amounts of non-protein food, but females given 85% non-protein diet had a significantly higher standard length than females given 69 or 53% non-protein components. A significantly higher total body weight was also found in the groups fed on 85% non-protein diet than among females given 53% non-protein. The frequencies of females with only intrafollicular embryos or with both embryos and ova alternatively with only previtellogenic oocytes in the ovary were not significantly different between populations fed on different non-protein contents. In the group given 69% non-protein the frequency of females with only ova was significantly higher than among females fed on 53% non-protein. The ovarian width, ovarian volume and gonad weight were all significantly higher in females given 85% non-protein than in females fed on 53% non-protein. There were no significant differences of fecundity and fertility between any groups given different amounts of non-protein (85, 69 and 53%). This was also true for embryo size and ovum diameter.

80-002494 Fowler, L. G. STARTING DIETS FOR CHINOOK SALMON FRY. *Prog. Fish-Cult.* 42(3):165-166. July 1980. SFA 25(4)
[Abernathy Salmon Cult. Dev. Cent., 1440 Abernathy Rd., Longview, WA 98632]

80-002495 Fukusho, K.; T. Arakawa and T. Watanabe. [FOOD VALUE OF A COPEPOD, *TIGRIOPUS JAPONICUS*, CULTURED WITH ω-YEAST FOR LARVAE AND JUVENILES OF MUD DAB *LIMANDA YOKOHAMAE*.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):499-503. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Natl. Res. Inst. Aquacult., Tamaki-cho, Mie 519-04, Japan]

80-002496 Ghittino, P. CONTROLLO DELLA CONVENIENZA, TOSSICITA E CANCEROGENICITA DI TOPRINA NELLA TROTA IRIDEA RAPPORTO FINALE. [CHECKING ON THE SUITABILITY, TOXICITY AND CANCEROGENICITY OF *TOPRINA* IN RAINBOW TROUT. FINAL REPORT.] *Riv. It. Piscic. Ittiop.* 15(2):36, 39-42, 45. Apr.-May-June 1980. In Italian with English summ. SFA 25(4)
[Ist. Zooprof. Sper., Via Bologna, 148-10154 Torino, Italy]

80-002497 Guerrero, R. D. III. STUDIES ON THE FEEDING OF *TILAPIA NILOTICA* IN FLOATING CAGES. *Aquaculture* 20(3):169-175. July 1980. SFA 25(4)
[Coll. Inland Fish., Cent. Luzon State Univ., Nueva Ecija, Philippines]

Five studies on the feeding of *Tilapia nilotica* in floating cages were conducted. Stocking densities of 100 to 200 fish per m^3 were used. Only commercially available ingredients were used in the feed. Results of the studies showed that diets containing fish meal, fine rice bran and copra meal had significantly better feed conversion ratios than diets with ipil-ipil leaf meal. Diets with 25% fish meal and 10% copra meal were found to be efficient and economical for *T. nilotica*. Chicken grower mash enriched with fish meal did not significantly differ from a diet consisting of 25% fish meal and 75% fine rice bran. Fish given moist pellets had significantly higher production than fish fed with dry pellets.

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

80-002498 Hung, S. S. O.; C. Y. Cho and S. J. Slinger. MEASUREMENT OF OXIDATION IN FISH OIL AND ITS EFFECT ON VITAMIN E NUTRITION OF RAINBOW TROUT (*SALMO GAIRDNERI*). *Can. J. Fish. Aquatic Sci.* 37(8):1248-1253. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Nutr., Coll. Biol. Sci., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

80-002499 Kanid'yev, A. N. and V. Ya. Sklyarov. DEVELOPMENT OF EFFICIENT GRANULATED FEEDS FOR THE RAINBOW TROUT, *SALMO GAIRDNERI*, BASED ON VEGETABLE AND BACTERIAL PROTEIN WITH SYNTHETIC AMINO ACIDS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):140-146. 1979. SFA 25(4)
[VNIIPRKh, Rybnoye Post. Dist., Moscow Prov., USSR] With the object of reducing the cost of high-quality granulated feeds for the rainbow trout, *Salmo gairdneri*, trials were conducted on the replacement of animal protein by an adequate amount of vegetable and bacterial protein from sunflower oil cake, and hydrolyzed and carbonaceous yeasts (PVC -protein-vitamin concentrate). The resulting deficiency of "key" amino acids (lysine and methionine) was compensated by their synthetic analogs. The possibility of providing the trout with vitamins of group B from the PVC was verified. As a result of testing food mixtures it was established that losses of animal protein per unit of growth were reduced by almost 10 times, and the cost of the unit of growth reduced by 33%. Although the rate of growth of the trout decreased by 10%, the efficiency of commercial rearing increased considerably.

80-002500 Kaushik, S. and P. Luquet. ÉTUDE DE LA DIGESTIBILITÉ DES ACIDES AMINÉS DE RÉGIMES A BASE DE ZÉINE CHEZ LA TRUITE ARC-EN-CIEL. [STUDY OF THE AMINO ACIDS DIGESTIBILITY OF ZEIN DIETS IN RAINBOW TROUT.] *Ann. Hydrobiol.* 7(1):11-19. 1976. In French with English summ. SFA 25(4)
[Lab. Nutr. Poissons, I.N.R.A., Cent. Natl. Rech. Zootech., 78350 Jouy en Josas, France] The coefficients of apparent digestibility (CUD) of amino acids in rainbow trout were studied using semi-purified diets having zein or a mixture of zein-fishmeal as the principal protein sources. The results of this experiment indicate that the protein digestibility value of the diets having both the protein sources is good (92 p. 100) and is superior than the one containing only zein (89 p. 100). The digestibility of individual amino acids in the different diets reflect in general this pattern, but for those added in free form in the diet. Thus, arginine is more easily digested (93 p. 100) from the diet having both zein and fish meal than from the one having only zein (85 p. 100). Supplementation of 2.6 p. 100 of this amino acid in crystalline form to the former diet increases the CUD of arginine to 97.5 p. 100. In the light of its high digestiblility values, zein duly completed or supplemented appears to be a very good tool of research for amino acid requirement studies.

80-002501 Ogino, C. and G.-Y. Yang. [REQUIREMENTS OF CARP AND RAINBOW TROUT FOR DIETARY MANGANESE AND COPPER.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):455-458. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan-4, Minato-ku, Tokyo 108, Japan] Carp, *Cyprinus carpio*, and rainbow trout, *Salmo gairdneri*, were fed on the diets containing different amounts of Mn and Cu for 12 to 16 weeks, respectively. The feeding with the low Mn-diet (4 ppm Mn) resulted in lower growth rate than the control diet (12-13 ppm Mn) in both fish species. In the rainbow trout, the malformation such as an abnormal growth of the tail and the shortening of the body length developed in the fish receiving the low Mn-diet. The development of the malformation was considered to be due to the abnormal formation of the bones by the Mn-deficiency. The low Cu-diet (0.7 ppm Cu) produced lower growth rate than the control diet (3 ppm Cu) in the Carp and not in the rainbow trout. The contents of Mn and Cu in the tissues from the fish fed with the low Mn- or low Cu-diet decreased distinctly in

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

80-002501 CONTINUED both fish species. Judging from the experimental results, the optimum dietary levels of Mn and Cu were considered to be around 12-13 ppm and around 3 ppm, respectively, in both the carp and the rainbow trout.

80-002502 Pfeffer, E.; R. Petrasch and O. Eckhardt. UNTERSUCHUNGEN ÜBER MÖGLICHE PROTEIN- UND FETTTRÄGER IN GEREINIGTEN DIÄTEN FÜR REGENBOGENFORELLEN (*SALMO GAIRDNERI*, R.). [STUDIES ON POSSIBLE SOURCES OF PROTEIN AND FAT IN PURIFIED DIETS FOR RAINBOW TROUT (*SALMO GAIRNDERI*, R.).] *J. Anim. Physiol. Anim. Nutr.* 43(4-5):254-263. 1980. In German with English summ. SFA 25(4)
[Univ. Göttingen, West Germany]

80-002503 Skrede, A.; Å. Krogdahl and E. Austreng. DIGESTIBILITY OF AMINO ACIDS IN RAW FISH FLESH AND MEAT-AND-BONE MEAL FOR THE CHICKEN, FOX, MINK AND RAINBOW TROUT. *J. Anim. Physiol. Anim. Nutr.* 43(2):92-101. Feb. 1980. In English with German summ. SFA 25(3)
[Dep. Poultry Fur Anim. Sci., Agric. Univ. Norway, AS-NLH, Norway]

80-002504 Spataru, P.; B. Hepher and A. Halevy. THE EFFECT OF THE METHOD OF SUPPLEMENTARY FEED APPLICATION ON THE FEEDING HABITS OF CARP (*CYPRINUS CARPIO* L.) WITH REGARD TO NATURAL FOOD IN PONDS. *Hydrobiologia* 72(1-2):171-178. 10 July 1980. SFA 25(4)
[Fish Aquacult. Res. Stn., Dor, Israel] Qualitative and quantitative analyses were carried out on the intestinal content of 408 carps of age 0+ collected from ponds manured with liquid cowshed manure, with or without the addition of supplementary feed. These analyses were combined with a study of the benthos in the same ponds. Conclusions drawn were that the natural food preferred by this fish species consists of the components of the zoobenthos, especially larvae and pupae of chironomids. When the carp were fed supplementary feed through a demand feeder, the natural food consumed was mainly from the surface layers of the water, such as pupae of chironomids at the last stage of their development, before or during the hatching of the adult, Heteroptera, and also Cladocera, Copepoda and Rotatoria from the zooplankton. The daily addition of liquid cow manure caused harsher environmental conditions in the water, led to a decrease in the number of species of the benthos and of the plankton, and consequently had an influence on the trophic spectrum of the carp. Supplementary feed when available, replaces some of the natural food and it seems that the carp seeks more easily accessible food items.

80-002505 Takeuchi, L.; T. Takeuchi and C. Ogino. [RIBOFLAVIN REQUIREMENTS IN CARP AND RAINBOW TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 46(6):733-737. June 1980. In Japanese with English summ. SFA 25(4)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan-4, Minato-ku, Tokyo 108, Japan]

80-002506 Willis, D. W. and S. A. Flickinger. TRAINING SUCCESS OF BROOK AND BROWN TROUT ONTO A PREPARED DIET. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:42-46. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[Dep. Fish. Wildl., Colo. State Univ., Fort Collins 80523] Training success of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) fry was determined using three training diet sequences: ground beef liver to Biodiet, carp (*Cyprinus carpio*) eggs to Biodiet, and Biodiet alone. Mean training success of the brown trout onto the liver sequence was 93.5 percent, to the carp egg sequence was 98.5 percent, and to the Biodiet alone was 97.5 percent. Mean training success of the brook trout onto the liver sequence was 73.5 percent, to the carp egg sequence was 71.0 percent, and to the Biodiet

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80-002506 CONTINUED alone was 73.0 percent. No significant differences among diet sequences were found for the brown trout or the brook trout.

AQUARIUMS

80-002507 Dillon, C. (ed.). ZOOS AND AQUARIUMS IN THE AMERICAS 1980-1981. 256p. 1980. Available @ $15.00 from American Assoc. Zoological Parks and Aquariums, Oglebay Park, Wheeling, WV 26003. SFA 25(4)

80-002508 Jensen, N. J. SYSTEM OF INDIVIDUALLY TEMPERATURE-REGULATED SALTWATER AQUARIA. *Prog. Fish-Cult.* 42(3):166-168. July 1980. SFA 25(4)
[R. Vet. Agric. Univ., Lab. Aquatic Pathobiol., Bülowsvej 13, DK-1870 Copenhagen V, Denmark]

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

80-002509 Khoo Khay Huat. STIMULATION OF OVARIAN MATURATION IN FISH BY SUSTAINED HORMONE PREPARATIONS. *Aquaculture* 20(3):275-280. July 1980. SFA 25(4)
[Sch. Biol. Sci., Univ. Sains Malaysia, Minden, Penang, Malaysia] Ovarian maturation of *Carassius auratus* and *Ophiocephalus striatus* was attempted using human chorionic gonadotrophin (HCG) pellets and cholesterol pellets as a control. Fish were kept under photoperiod and natural conditions. Implantations of HCG induced a significant increase in the gonadosomatic index of female fish kept in total darkness, and in natural conditions. At the end of 6 weeks the fish treated with HCG had both Stage I and Stage II oocytes, and development within Stage II to the yolk granula and fatty yolk oocyte stages. The author recommended the sustained-release preparation technique for inducing spawning in fish difficult to breed.

80-002510 Mandal, B. K. and C. E. Boyd. REDUCTION OF pH IN WATERS WITH HIGH TOTAL ALKALINITY AND LOW TOTAL HARDNESS. *Prog. Fish-Cult.* 42(3):183-185. July 1980. SFA 25(4)
[Dep. Fish. Allied Aquacult., Auburn Univ. Agric. Exp. Stn., Auburn, AL 36830]

80-002511 Robinson, T. THE MICROCOMPUTER AS A TOOL OF FISH CULTURE. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:97-98. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)
[Colo. Div. Wildl., Glenwood Springs]

80-002512 Withler, F. C. CHILLED AND CRYOGENIC STORAGE OF GAMETES OF THAI CARPS AND CATFISHES. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 948. iii + 15p. June 1980. In English with French summ. SFA 25(3)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Fertilizabilities of ova and sperm of Indian carp *Labeo rohita*, common carp *Cyprinus carpio*, Puntius *Puntius gonionotus*, grass carp *Ctenopharyngodon idella*,

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT (CONTINUED)

80-002512 CONTINUED bighead carp *Aristichthys nobilis* and the catfish *Pangasius sutchi* were examined after storage in refrigerators or on ice or in liquid nitrogen (LN_2). The period of fertilizability of ova after extrusion was not extended significantly by chilled storage in a refrigerator. The period during which sperm could be activiated after extrusion was extended to several hours by chilled storage in syringes. Carp sperm (Indian carp, common carp, Puntius, bighead carp) mixed with an extending solution containing DMSO could be activated after storage for various periods in LN_2. In one trial, Indian carp sperm stored in LN_2 fertilized ova as well as fresh sperm applied to a control group of ova. *P. sutchi* sperm in either of the two extenders used, and stored in LN_2, produced a gel which could not be used effectively in fertilizing ova. A description of current methods of inducing maturation by injection of macerated pituitary glands is given. Recommendations are made for further work on gamete storage applicable to Thai fish culture.

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-002513 Carlson, J. B. and G. E. Ahlgren. A TECHNIQUE FOR COLLECTING WATER SAMPLES UNDER EXTREME WINTER CONDITIONS. *J. Minn. Acad. Sci.* 46(1):16-17. 1980. SFA 25(4)

[Dep. Biol., Univ. Minn., Duluth] The construction and use of a simple water sampler for winter limnological studies is described. Data presented indicate that water samples taken with this device and by a mechanical hand-operated suction pump over a wide range of temperatures do not differ significantly (P is less than 0.05, t-test) in the dissolved oxygen concentration determined by the Winkler titration. Certain distinct advantages of a static water sampler are discussed.

80-002514 LaBounty, J. F. and J. J. Sartoris. THE EFFECTS OF DROUGHT VERSUS WET YEARS ON THE LIMNOLOGY OF LAKES AND RESERVOIRS IN COLORADO AND WYOMING. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:99. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)

[U.S. Water Power Resour. Serv., Denver, CO] The Bureau of Reclamation has been monitoring several limnological parameters of Twin Lakes, Colorado and the uppermost North Platte Reservoirs, Wyoming, for the past 7 and 4 years, respectively. The occurrence of two drought and two wet years during the periods of study has provided the opportunity to assess the effects of low versus high runoff years on the limnology of the reservoirs. Analysis of data collected from these dissimilar aquatic ecosystems indicated that during the post-drought wet years, plankton populations increased from 6 to 10 times over what they were during the drought years. Twin Lakes are a pair of high-mountain, glacially-formed dimictic oligotrophic lakes, while the four reservoirs on the upper North Platte are high plains reservoirs which are mesotrophic. While both systems are similar in that they are heavily influenced by the amount of annual spring runoff, they differ greatly in their basic limnological features, such as physcial lake form, thermal structure, water chemistry, plankton species composition and abundance, and type of fishery. This paper discusses the similarities in the effects years with above average runoff and those with below average runoff have on these two dissimilar environments. It is expected since plankton populations were depressed during drought years and luxuriant during wet years, that the top carnivore would reflect their food source in abundance for the respective year classes.

GENERAL LIMNOLOGY AND OCEANOGRAPHY (CONTINUED)

80-002515 Sartoris, J. J. and J. F. LaBounty. LIMNOLOGY OF THE NORTH PLATTE RESERVOIR SYSTEM, WYOMING. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:97. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901] Abstract only. SFA 25(4)
[U.S. Water Power Resour. Serv., Denver, CO]

PHYSICAL LIMNOLOGY AND OCEANOGRAPHY

80-002516 Kranck, K. VARIABILITY OF PARTICULATE MATTER IN A SMALL COASTAL INLET. *Can. J. Fish. Aquatic Sci.* 37(8):1209-1215. Aug. 1980. In English with French summ. SFA 25(4)
[Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada]

80-002517 Lane, E. D. and R. G. Newstead. THREE-DIMENSIONAL COMPUTER MAPPING OF LAKES. *Prog. Fish-Cult.* 42(3):136-137. July 1980. SFA 25(4)
[Fish Cult. Prog., Malaspina Coll., Nanaimo, BC V9R 5S5, Canada]

CHEMICAL LIMNOLOGY AND OCEANOGRAPHY

80-002518 Boyd, C. E. and L. Tucker. DETERMINATION OF FILTRABLE ORTHOPHOSPHATE IN WATER FROM FISH PONDS. *Trans. Am. Fish. Soc.* 109(3):314-318. May 1980. SFA 25(4)
[Dep. Fish. Allied Aquacult., Auburn Univ. Agric. Exp. Stn., Auburn, AL 36830]

80-002519 Campbell, P. and T. Torgersen. MAINTENANCE OF IRON MEROMIXIS BY IRON REDEPOSITION IN A RAPIDLY FLUSHED MONIMOLIMNION. *Can. J. Fish. Aquatic Sci.* 37(8):1303-1313. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

80-002520 Nakashima, B. S. THE CONTRIBUTION OF FISHES TO PHOSPHORUS CYCLING IN LAKES. *Ph.D. dissertation, McGill Univ. (Canada)* 1980. From Diss. Abstr. Int. B Sci. Eng. 41(3):822. Sept. 1980. SFA 25(4)
Several hypotheses concerning the role of fishes in influencing nutrient dynamics in freshwater ecosystems were examined in Lake Memphremagog (Quebec-Vermont). Phosphorus excretion by fishes provides a negligible amount (<0.33%) in comparison to the quantity taken up by the seston. The phosphorus pools present in the seston and fish community were approximately equal and both were twice the phosphorus content in the zooplankton. Part of this nutrient reservoir is released during the decompositon of fish carcasses. The potential is dependent upon post-spawning mortality rate, the fate of phosphorus in decomposing fish tissue, and the concentrations of allochthonous phosphorus entering the lake. Daily losses of epilimnetic phosphorus from the seston due to fish (up to 40%) and enhancement of nutrient excretion by zooplankton due to size-selective predation are important when open water fish populations are mainly planktivores. When benthic, detrital, or faculative consumers predominate, as in Lake Memphremagog, the effect of fishes on nutrient dynamics through foraging pressue is probably small.

BENTHOS

80-002521 Hulberg, L. W. and J. S. Oliver. CAGING MANIPULATIONS IN MARINE SOFT-BOTTOM COMMUNITIES: IMPORTANCE OF ANIMAL INTERACTIONS OR SEDIMENTARY HABITAT MODIFICATIONS. *Can. J. Fish. Aquatic Sci.* 37(7):1130-1139. July 1980. SFA 25(4)
[Moss Landing Mar. Lab., P.O. Box 223, Moss Landing, CA 95039]

80-002522 Molles, M. C., Jr. RECOVERY OF STREAM INVERTEBRATES FROM DISTURBANCE RESULTING FROM A FLASH FLOOD. *Bull. Ecol. Soc. Am.* 61(2):96. June 1980. Abstract only. SFA 25(4)
[Univ. N. Mex., Albuquerque] In mid-August 1977 a flash flood disrupted the benthic community of one of two forks of Tesuque Creek, Santa Fe National Forest, New Mexico. A study of the disturbed stream was undertaken to 1) determine the rate of recovery of benthic invertebrates and 2) compare rates of recovery upstream and downstream from the undisturbed fork. One year after the disturbance, the invertebrate communities of the flooded and unflooded sites were similar in biomass, numbers of individuals, and numbers of species. However, some differences in composition of the benthos remained. Trichoptera and Coleoptera appeared to recover most slowly from the effects of the flood. It is suggested that these two orders may be useful as indicators of the flow stability of streams. Recovery appeared to proceed at approximately equal rates upstream and downstream from the undisturbed fork.

80-002523 Parker, J. I. PREDATION BY *MYSIS RELICTA* ON *PONTOPOREIA HOYI*: A FOOD CHAIN LINK OF POTENTIAL IMPORTANCE IN THE GREAT LAKES. *J. Great Lakes Res.* 6(2):164-166. 1980. SFA 25(4)
[Ecol. Sci. Sect., Radiol. Environ. Res. Div., Argonne Natl. Lab., Argonne, IL 60439] Sediment cores composed of benthic microorganisms and the natural assemblage of benthic fauna from Lakes Michigan and Erie were maintained intact at 4°C in a laboratory incubator for 10 weeks. Visual inspection of the microcosms showed that the opossum shrimp *Mysis relicta*, an omnivorous planktivore, frequently preyed on the burrowing amphipod *Pontoporeia hoyi*, a benthic detritivore; a previously unreported predator/prey relationship. Predation by *Mysis* on *Pontoporeia* demonstates that *Mysis* can utilize not only the plankton carbon pool but the benthic/detrital carbon pool as well. This relationship may represent an important link in the food web of the Great Lakes, since *Pontoporeia* is the dominant macrobenthic organism in the lakes and both organisms are an important source for immature salmonids and other fish species in the Great Lakes.

PLANKTON

80-002524 Bitton, G.; J. R. Beaver and S. R. Farrah. ORGANIC FLOCCULATION AND HYDROEXTRACTION: TWO NEW METHODS FOR PHYTOPLANKTON CONCENTRATION FROM LAKES. *Can. J. Fish. Aquatic Sci.* 37(8):1317-1320. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Environ. Eng., Univ. Fla., Gainesville 32611]

PRIMARY PRODUCTION

80-002525 Kwiatkowski, R. E. CHLOROPHYLL a MEASUREMENTS FROM LAKE

PRIMARY PRODUCTION (CONTINUED)

80-002525 CONTINUED ONTARIO, 1974-79. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 933. viii + 75p. May 1980. In English with French summ. SFA 25(4)
[Canada Cent. Inland Waters, 867 Lakeshore Rd., Burlington, ON L7R 4A6, Canada]

MORPHOLOGY

80-002526 Boëtius, J. ATLANTIC *ANGUILLA*. A PRESENTATION OF OLD AND NEW DATA OF TOTAL NUMBERS OF VERTEBRAE WITH SPECIAL REFERENCE TO THE OCCURRENCE OF *ANGUILLA ROSTRATA* IN EUROPE. *Dana* 1:93-112. 1980. SFA 25(4)
[Danish Inst. Fish. Mar. Res., Charlottenlund Castle, DK-2920 Charlottenlund, Denmark]

80-002527 Alvarez-León, R. A SPECIMEN OF *LUTJANUS ARGENTIVENTRIS* (PETERS) LACKING PELVIC FINS. *J. Fish Biol.* 16(5):563-564. May 1980. SFA 25(4)
[Inderena, Subgerencia de Pesca, Bogotá, Colombia]

80-002528 Anthony, J. ÉVOCATION DES TRAVAUX FRANÇAIS SUR *LATIMERIA* NOTAMMENT DEPUIS 1972. [RECALLING FRENCH STUDIES OF *LATIMERIA* ESPECIALLY SINCE 1972.] *Proc. R. Soc. Lond. B Biol. Sci.* 208(1172):349-367. 17 July 1980. In French with English summ. SFA 25(4)
[Lab. Anat. Comp., Mus. Natl. Hist. Nat., 55 Rue de Buffon, 75-Paris-5, France]

80-002529 Bagiryan, S. Sh. and A. T. Terekhin. [AN EXPERIENCE OF USING MULTIVARIATE STATISTICAL METHODS FOR ANALYSIS OF THE INTRASPECIFIC STRUCTURE OF *SALMO MYKISS* WALBAUM (SALMONIFORMES, SALMONIDAE).] *Zool. Zh.* 59(6):859-869. June 1980. In Russian with English summ. SFA 25(4)
[Biol. Fac., State Univ. Moscow, USSR]

80-002530 Ballard, W. W. and A. S. Ginsburg. MORPHOGENETIC MOVEMENTS IN ACIPENSERID EMBRYOS. *J. Exp. Zool.* 213(1):69-103. July 1980. SFA 25(4)
[Biol. Dep., Dartmouth Coll., Hanover, NH 03755]

80-002531 Best, A. C. G. and J. A. B. Gray. MORPHOLOGY OF THE UTRICULAR RECESS IN THE SPRAT. *J. Mar. Biol. Assoc. U.K.* 60(3):703-715. Aug. 1980. SFA 25(4)
[Lab. Mar. Biol. Assoc., Citadel Hill, Plymouth, England]

80-002532 Burr, B. M. and M. S. Ellinger. DISTINCTIVE EGG MORPHOLOGY AND ITS RELATIONSHIP TO DEVELOPMENT IN THE PERCID FISH *ETHEOSTOMA PROELIARE*. *Copeia* 1980(3):556-559. 6 Sept. 1980. SFA 25(4)
[Dep. Zool., South Ill. Univ., Carbondale 62901]

80-002533 Buynak, G. L. and H. W. Mohr, Jr. LARVAL DEVELOPMENT OF STONEROLLER, CUTLIPS MINNOW, AND RIVER CHUB WITH DIAGNOSTIC KEYS, INCLUDING FOUR ADDITIONAL CYPRINIDS. *Prog. Fish-Cult.* 42(3):127-135. July 1980. SFA 25(4)
[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603]

MORPHOLOGY (CONTINUED)

80-002534 Chaturvedi, L. D.; B. D. Joshi and B. B. Sharma. THE TELENCEPHALIC FIBRE CONNECTIONS IN THREE FRESHWATER TELEOSTS. *J. Anim. Morphol. Physiol.* 26(1/2):177-181. June-Dec. 1979. SFA 25(4)
[P.G. Dep. Zool., Hindu Coll., Moradabad (U.P.), India]

80-002535 Collins, L. A.; J. H. Finucane and L. E. Barger. DESCRIPTION OF LARVAL AND JUVENILE RED SNAPPER, *LUTJANUS CAMPECHANUS*. *NOAA Fish. Bull.* 77(4):965-974. 1980. SFA 25(4)
[NMFS, 3500 Delwood Beach Rd., Panama City, FL 32407]

80-002536 Cooper, J. E. EGG, LARVAL AND JUVENILE DEVELOPMENT OF LONGNOSE DACE, *RHINICHTHYS CATARACTAE*, AND RIVER CHUB, *NOCOMIS MICROPOGON*, WITH NOTES ON THEIR HYBRIDIZATION. *Copeia* 1980(3):469-478. 6 Sept. 1980. SFA 25(4)
[Ecological Analysts, Inc., York Bldg., 8600 LaSalle Rd., Towson, MD 21204]

80-002537 Desai, A. K. COMPARATIVE STRUCTURAL CHANGES IN THE KIDNEY OF *HILSA ILISHA* AND *HILSA TOLI* AS RELATED TO MIGRATORY HABITS. *J. Anim. Morphol. Physiol.* 26(1/2):220-227. June-Dec. 1979. SFA 25(4)
[Dep. Zool., Fac. Sci., M.S. Univ. Baroda, Baroda, 390 002, India]

80-002538 Desai, A. K. HISTOLOGICAL OBSERVATIONS ON CATECHOLAMINE SECRETING CELLS IN THE HEART OF MIGRATORY *HILSA ILISHA* AND NON-MIGRATORY *HILSHA TOLI*. *J. Anim. Morphol. Physiol.* 26(1/2):252-256. June-Dec. 1979. SFA 25(4)
[Dep. Zool., Fac. Sci., M.S. Univ. Baroda, Baroda-390 002, India]

80-002539 Dunel-Erb, S. and P. Laurent. ULTRASTRUCTURE OF MARINE TELEOST GILL EPITHELIA: SEM AND TEM STUDY OF THE CHLORIDE CELL APICAL MEMBRANE. *J. Morphol.* 165(2):175-186. Aug. 1980. SFA 25(4)
[Lab. Physiol. Comp. Reg., CNRS, B.P. 20 CR, 67037 Strasbourg, France]

80-002540 Ellertsen, B.; P. Solemdal; T. Strømme; S. Tilseth;T. Westgård; E. Moksness and V. Øiestad. SOME BIOLOGICAL ASPECTS OF COD LARVAE (*GADUS MORHUA* L.). *Fiskeridir. Skr. Ser. Havunders.* 17(2):29-47. 1980. SFA 25(4)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway]

80-002541 Eys, G. J. J. M. van. STRUCTURAL CHANGES IN THE PARS INTERMEDIA OF THE CICHLID TELEOST *SAROTHERODON MOSSAMBICUS* AS A RESULT OF BACKGROUND ADAPTATION AND ILLUMINATION. II. THE PAS-POSITIVE CELLS. *Cell Tissue Res.* 210(2):171-179. Aug. 1980. SFA 25(4)
[Dep. Zool., Univ. Nijmegen, Toernooweld 25, The Netherlands]

80-002542 Fives, J. M. AN ACCOUNT OF THE EGGS AND EARLY DEVELOPMENTAL STAGES OF MONTAGU'S BLENNY, *CORYPHOBLENNIUS GALERITA* (L.), WITH NOTES ON THE REPRODUCTIVE BEHAVIOUR OF THE ADULTS. *J. Mar. Biol. Assoc. U.K.* 60(3):749-757. Aug. 1980. SFA 25(4)
[Dep. Zool., University Coll., Galway, U.K.] Montagu's blenny, *Coryphoblennius galerita* was reared to late larval stage under laboratory conditions. The adult male guarded the eggs and aerated them with its tail during the incubation period. The larvae had a small amount of yolk on hatching and although they appeared to be feeding on the variety of food

MORPHOLOGY (CONTINUED)

80-002542 CONTINUED introduced, no food was observed in the gut. The gas bladder, observable above the gut in all larvae, was filled with gas only in the one specimen, killed at 4.5 min T.L., which survived after the yolk was utilized, and in some 4 mm specimens taken from the plankton off Mweenish. Descriptions are given of the larval stages and of juveniles taken from rock pools.

80-002543 Galis, F. and C. D. N. Barel. COMPARATIVE FUNCTIONAL MORPHOLOGY OF THE GILLS OF AFRICAN LACUSTRINE CICHLIDAE (PISCES, TELEOSTEI). AN ECO-MORPHOLOGICAL APPROACH. *Neth. J. Zool.* 30(2):392-430. June 1980. SFA 25(4)
[Dep. Morphol., Zool. Lab., Univ. Leiden, The Netherlands]

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80-002548 Hoffmann, R.; P. Wondrak and W. Groth. SEASONAL ANATOMICAL VARIATIONS IN THE TESTES OF EUROPEAN PIKE, *ESOX LUCIUS* L. *J. Fish Biol.* 16(5):475-482. May 1980. SFA 25(4)
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[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Developmental series of larvae and juveniles of two important and very similar species of northeast Pacific rockfishes (Scorpaenidae: *Sebastes*) are described and illustrated: *S. flavidus* (10.1-105.0 mm standard length) and *S. melanops* (10.6-111.6 mm standard length). Descriptions include a literature review, identification, distinguishing features, general development, morphology, fin development, spination, scale formation, pigmentation, and color of fresh specimens. The main differences between *S. flavidus* and *S. melanops* within the size range described are pectoral fin ray number (usually 18 versus 19), lateral line pore number (usually >50 versus <50), and caudal peduncle depth/caudal peduncle length ration (mean values 0.73, 0.64, 0.64, 0.80 versus 0.88, 0.78, 0.74, 0.92 in postflexion larvae, transforming, pelagic juvenile, and benthic juvenile specimens, respectively). Occurrence of these two species in waters off Oregon is discussed. Small benthic juveniles of *S. flavidus* seem to inhabit deeper waters, >20 m depth, than those of *S. melanops*. Comparisons are made among known larvae and juveniles of *Sebastes* species. Identification problems within the *S. flavidus-S. melanops/S. entomelas-S. mystinus* groups are discussed.

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[N.C. A&T State Univ., Greensboro] Relatively little is known about the mechanism or significance of melanism which rarely is encountered in some males of some southeastern populations of mosquitofish, *Gambusia affinis holbrooki*. The possible adaptive advantage of sexual selection by means of female choice for rare males was investigated. In an aquarium with compartments designed to physically but not visually isolate subjects, females were given a 1:1 choice between a melanic male and a normal male. Females which had previous experience with melanic males in nature demonstrated cooperative sexual responses to both types of males equally, as did females which had never experienced melanic males in nature. Thus, it is likely that some factor other than sexual selection (e.g., competition for resources other than mates) is responsible for the occurrence of melanism in male mosquitofish.

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[Dep. Zool., Univ. Melbourne, Parkville, 3052, Victoria, Australia]

80-002560 Peňáz, M. and J. Gajdůšek. EARLY DEVELOPMENT OF BREAM, *ABRAMIS BRAMA*, FROM THE WATER RESERVOIR MOSTIŠTĚ, CZECHOSLOVAKIA. *Folia Zool.* 28(4):347-360. 1979. SFA 25(4)

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80-002562 Rasmussen, R. P. EGG AND LARVA DEVELOPMENT OF BROOK SILVERSIDES FROM THE PEACE RIVER, FLORIDA. *Trans. Am. Fish. Soc.* 109(4):407-416. July 1980. SFA 25(4)

[Texas Instruments, Inc., P.O. Box 225621, MS 349, Dallas, TX 75268]

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[Inst. Geol. Palaontol., University, Sigwartstr. 10, D-7400 Türbingen, West Germany]

80-002565 Reimchen, T. E. SPINE DEFICIENCY AND POLYMORPHISM IN A POPULATION OF *GASTEROSTEUS ACULEATUS*: AN ADAPTATION TO PREDATORS? *Can. J. Zool.* 58(7):1232-1244. July 1980. In English with French summ. SFA 25(4)

[Drizzle Lake Ecol. Reserve, Box 297, Port Clements, Queen Charlotte Islands, BC V0T 1R0, Canada] A population of *Gasterosteus aculeatus* from a muskeg lake on the Queen Charlotte Islands shows a spine polymorphism, with

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80-002565 CONTINUED 80% lacking the second dorsal spine and 68% lacking the pelvic spines. Females were more prevalent among phenotypes with greater spine number, and males were more common among those with fewer spines. Adult females, as well as juveniles of both sexes with pelvic spines, were more frequent in the limnetic habitat, whereas adult males and juveniles without pelvic spines were common in the littoral region. Five species of piscivorous birds, each in low numbers, foraged in the lake. Extensive predation in the limnetic region by *Gavia immer* and, secondarily, *Podiceps* spp. is implicated as a selective pressure favouring the greater spined phenotype. Odonate nymphs (*Aeshna* spp.) consumed juvenile fish in predation experiments and in the lake proper. Nymphs were common in the littoral zone, where submerged debris provided substrate for foraging. It is proposed that spine loss in this population of *G. aculeatus* is an adaptation to the hunting technique of *Aesna*, whereby reduced external structures such as spines minimize frictional contact for a grappling predator. Experimental data and other gasterosteid populations are discussed with reference to these proposals.

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[Inst. Allg. Spez. Zool., Justus-Liebig Univ., Stephanstr. 24, D-6300 Giessen, West Germany]

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[CSIRO, Davies Lab., Private Mail Bag, P.O. Townsville, Queensland 4810, Australia]

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[Dep. Gen. Physiol., Inst. Biosci., Univ. San Paulo, C. P. 11.461, San Paulo, Brazil]

80-002576 Verigina, I. A. PECULIARITIES OF THE ALIMENTARY CANAL OF THE PREDATORY CYPRINID, *OPSARICHTHYS UNCIROSTRIS AMURENSIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):92-97. 1979. SFA 25(4)
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80-002581 CONTINUED FEMALE SILVER EELS, *ANGUILLA ANGUILLA*. ESTIMATES OF FECUNDITY AND ENERGY RESERVES FOR MIGRATION AND SPAWNING. *Dana* 1:1-28. 1980. SFA 25(4)

[Danish Inst. Fish. Mar. Res., Charlottenlund Castle, DK-2920 Charlottenlund, Denmark] Female silver eels at body weights of 0.5 to 1.5 kg were treated with acetone-dried carp pituitaries and other gonadotrophic substances. Experiments were made in sea water at 23°C. The most successful treatment proved to be 15 mg carp pituitary + 500 IU HCG twice a week. This dosage resulted in strip-ripe eels in 40-80 days. Maximum gonado-somatic index: 60.7. Attempts at fertilization succeeded in a few cases, but embryonic development ceased at early stages (gastrula). The estimated fecundity of matured eels ranged from 0.7 to 2.6 million eggs. Ovaries and somatic bodies of matured eels were analysed for contents of water, lipid and protein. Based on the calculated energy reserves a rough estimate of an energy budget for migration and spawning was established.

80-002582 Aida, K.; R. S. Nishioka and H. A. Bern. CHANGES IN THE CORPUSCLES OF STANNIUS OF COHO SALMON (*ONCORHYNCHUS KISUTCH*) DURING SMOLTIFICATION AND SEAWATER ADAPTATION. *Gen. Comp. Endocrinol.* 41(3):296-304. July 1980. SFA 25(4)

[Dep. Fish., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo, Japan] Two types of cells (type 1 with large granules and type 2 with small granules) are present in the corpuscles of Stannius of the coho salmon, *Oncorhynchus kisutch*, during smoltification. The cells increase in size during normal smoltification and are equally large in freshwater and seawater smolts; in abnormal stunted fish in seawater the mean cell size is similar to that characteristic of parr. Nevertheless, the predominant type 1 cells (as well as the less frequent type 2 cells) in stunts appear active and are relatively depleted of granules. Type 1 cells may be associated with hypocalcin secretion; release of this hormone may be greater in stunts than in normal seawater smolts, possibly owing to initial difficulty of these incompletely smoltified fish to adjust to the seawater environment.

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[Lab. Physiol., Fac. Integrated Arts Sci., Hiroshima Univ., Higashisenda-machi, Hiroshima 730, Japan]

80-002585 Armstrong, P. B. TIME-LAPSE CINEMICROGRAPHIC STUDIES OF CELL MOTILITY DURING MORPHOGENESIS OF THE EMBRYONIC YOLK SAC OF *FUNDULUS HETEROCLITUS* (PISCES: TELEOSTI). *J. Morphol.* 165(1):13-29. July 1980. SFA 25(4)

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[Dep. Ichthyol., Moscow Univ., USSR]

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[Estacion Invest. Pesq. Torre de la Sal, Ribera de Cabanes, Castellón, Spain]

80-002595 Chikhachev, A. S.; V. A. Boryakin and V. V. Tyan'kin. RESISTANCE OF YOUNG STURGEON HYBRIDS (ACIPENSERIDAE) TO EXTREME CONDITONS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):155-158. 1979. SFA 25(4)
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[Liver Res. Cent., Albert Einstein Coll. Med., Bronx, NY 10461]

80-002597 Claiborne, J. B. and D. H. Evans. THE ISOLATED, PERFUSED HEAD OF THE MARINE TELEOST FISH, *MYOXOCEPHALUS OCTODECIMSPINOSUS*: HEMODYNAMIC EFFECTS OF EPINEPHRINE. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 138(1):79-85. July 1980. SFA 25(4)
[Dep. Biol., Univ. Miami, Coral Gables, FL 33124]

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[Univ. Alberta, Dep. Zool., Edmonton, AB T6G 2E9, Canada]

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[Dep. Ecol. Evol., State Univ. N.Y., Stony Brook 11794] Eggs of Atlantic menhaden, *Brevoortia tyrannus*, were artificially fertilized and embryos were reared in the laboratory at 12 temperature-salinity combinations (temperature: 10°, 15°, 20°, and 25° C; salinity: 10, 20, 30 °/oo). Salinity between 10 and 30 °/oo had no significant effect on embryonic mortality and no noticeable effect on rate of development. Temperature had a significant effect on embryonic mortality and rate of development. Embryonic mortality was significantly greater at 10°C than at 15°, 20°, and 25°C, and significantly greater before than after blastopore closure at 15°, 20°, and 25°C. The temperature between 10° and 25°C is 3.89. Age of *B. tyrannus* embryos can be estimated by the regression of age on developmental stages when incubated at constant temperature.

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[N.E.R.C. Inst. Mar. Biochem., Aberdeen, AB1 3RA, Scotland]

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[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

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[Dep. Zool. Entomol, Colo. State Univ., Fort Collins 80523] White suckers select a higher body temperature at night and a lower temperature during daytime. Removal of the pineal organ eliminated their diel rhythm of behavioral thermoregulation. After pinealectomy fish failed to select a lower daytime temperature. These results suggest that the pineal organ is involved in the control of behavioral thermoregulation of this teleost fish.

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[Sch. Fish. Sci., Kitasato Univ., Sanriku-cho, Kesen-gun, Iwate 022-01, Japan]

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[Dep. Aquatic Biol. Fish., Univ. Kerala, Trivandrum-695007, Kerala, India]

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[Dep. Aquatic Biol. Fish., Univ. Kerala, Trivandrum-7, India]

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80-002630 CONTINUED
[Fish. Coll., Tamil Nadu Agric. Univ., Tuticorin 628003, India] The upper incipient lethal temperatures of the freshwater mullet, *Rhinomugil corsula*, acclimated to 15, 20, 25, 30 and 35°C in fresh water, were 32.4, 34.1, 36.0, 36.2 and 36.5°C respectively, and the corresponding lower lethal temperatures were 10.5, 11.5, 13.2, 15.8 and 19.5°C. The mullet has a total tolerance (area of thermal polygon) of 569°C^2 with an upper and lower thermal tolerance of 253 and 316°C. Likewise, the total resistance of the mullet was 391°C^2, with upper and lower resistance zones of 181 and 210°C respectively. The upper critical temperatures of swimming inhibition of *R. corsula* (17.2 cm; acclimation 30°C), determined in a swimming tunnel, were 35.2, 34.6 and 34.2 for water current velocities of 38, 62 and 77 cm/s respectively. The corresponding lower critical temperatures were 26.2, 27.5 and 28.1°C. These results indicated the stenothermal nature of the mullet by comparison with other fishes, e.g. *Tilapia mossambica*. In tests on the influence of ambient salinity on thermal resistance, *R. corsula* survived longest at 7°/oo (iso-osmotic salinity). At salinities above and below this point, survival times were shorter at any lethal temperature. In a tentative scheme for quantification of stress due to temperature and salinity at death (after acclimation to 30°C and tested at 37°C), the hypo-osmotic and hyper-osmotic stress were estimated to be 50 and 31% of the thermal stress (100%) respectively.

80-002631 Kuz'mina, V. V. THE LEVEL OF α-AMYLASE ACTIVITY IN THE BLOOD OF FRESH WATER TELEOSTS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):123-131. 1979. SFA 25(4)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok Yaroslavl Reg., USSR]

80-002632 Lapin, V. I. and V. Ye. Matsuk. UTILIZATION OF YOLK AND CHANGE IN THE BIOCHEMICAL COMPOSITION OF THE EGGS OF THE NAVAGA, *ELEGINUS NAVAGA*, DURING EMBRYONIC DEVELOPMENT. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):131-136. 1979. SFA 25(4)
[Dep. Ichthyol., Moscow Univ., USSR] The dynamics of the biochemical composition of the eggs of the navaga, *Eleginus navaga*, during embryonic development were studied. Considerable changes in the composition of the eggs during swelling after fertilization are connected mainly with the reorganization of substances stored in the yolk in order to adjust the osmotic pressure in the egg to environmental pressure. Total energy expediture during embryonic development constitutes approximately one-seventh of the substances contained in the oocyte.

80-002633 Lapina, N. N. and V. D. Spanovskaya. SEASONAL DYNAMICS OF THE BIOCHEMICAL COMPOSITION OF SOME ORGANS AND TISSUES OF THE WHITE BREAM, *BLICCA BJOERKNA*, FROM MOZHAYSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):121-129. 1979. SFA 25(4)
[Dep. Ichthyol., Moscow Univ., USSR]

80-002634 Leatherland, J. F. and R. A. Sonstegard. SEASONAL CHANGES IN THYROID HYPERPLASIA, SERUM THYROID HORMONE AND LIPID CONCENTRATIONS, AND PITUITARY GLAND STRUCTURE IN LAKE ONTARIO COHO SALMON, *ONCORHYNCHUS KISUTCH* WALBAUM AND A COMPARISON WITH COHO SALMON FROM LAKES MICHIGAN AND ERIE. *J. Fish Biol.* 16(5):539-562. May 1980. SFA 25(4)
[Dep. Zool., Coll. Biol. Sci., Univ. Guelph, Guelph, ON, Canada] A progressive fall in serum thyroid hormone levels was found in Lake Ontario coho salmon, *Oncorhynchus kisutch*, between May 1978 and January 1979 concomitant with an increase in goitre frequency and thyroid hyperplasia. Despite marked differences in overt goitre frequency in sexually mature adult salmon collected from lakes Ontario (43.7%), Erie (93.5%), or Michigan (0%), serum thyroid hormone levels and thyroid histology were similar in fish from

PHYSIOLOGY (CONTINUED)

80-002634 CONTINUED the three lakes. Two gonadotrop-like basophil cells ('globular' and 'vacuolar') were found in the pituitary, particularly in sexually maturing and mature adults and 'jacks'. Whereas in salmon from Lakes Ontario or Michigan, the globular cells were vacuolated in Lake Erie salmon they were not; this observation may be correlated with the absence of obvious secondary sexual characteristics in Lake Erie salmon. Serum free fatty acids serum, triglycerides and cholesterol concentrations in Lake Ontario salmon fell progressively from the condition in fish collected from the Lake in May 1978, to that of fish collected during their potamodrous migration in November 1978 and January 1979.

80-002635 Lesel, R. and M. Lesel. OBTENTION D'ALEVINS NON VÉSICULÉS AXÉNIQUES DE SALMONIDES. [OBTENTION OF GNOTOBIOTIC SALMONID FISH FRY.] *Ann. Hydrobiol.* 7(1):21-25. 1976. In French with English summ. SFA 25(4)
[Lab. Microorgan., Cent. Rech. Hydrobiol., I.N.R.A., B.P. 79, 64200 Biarritz, France] An easy method by disinfection of eyed eggs has been worked out in order to obtain gnotobiotic Salmonid fish fry. After checking the absence of bacteria, eggs are put in a plastic isolator, Trexler type, into a germfree water aquarium. The rearing method utilized has enabled a fry survival of 15 days after yolk sac resorption.

80-002636 Lizenko, Ye. I.; V. S. Sidorov, Z. A. Nefyodova and O. I. Potapova. THE CONTENT OF LIPID COMPONENTS IN THE EGG AND MILT OF THE CISCO, *COREGONUS ALBULA*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):158-161. 1979. SFA 25(4)
[Inst. Biol., Karelian Br., USSR Acad. Sci., Petrozavodsk, USSR]

80-002637 Locket, N. A. SOME ADVANCES IN COELACANTH BIOLOGY. *Proc. R. Soc. Lond. B Biol. Sci.* 208(1172):265-307. 17 July 1980. SFA 25(4)
[Dep. Anat., Univ. Adelaide, Box 498, G.P.O., Adelaide, 5001, Australia]

80-002638 Logan, W. T., Jr. TROUT HEALTH DETERMINATION THROUGH BLOOD INDICES AND HISTOLOGY. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:10-23. 1980. Available @$5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[904 Pioneer Ave., Fort Collins, CO 80521] Rainbow trout (*Salmo gairdneri*) health was evaluated in a two part study by hematology, blood chemistry and histology. Phase I of the study was designed to establish the ranges of various blood and tissue parameters compatible with normal health, utilizing two nutritionally complete and balanced ration regimes. Phase II of the study involved comparison of the parameters representing normal health with data obtained from four groups of trout at two Colorado Division of Wildlife trout culture facilities. The research has revealed that biologically significant differences in blood values should not occur in trout fed nutritionally complete and balanced rations. Variations in blood indices occur due to temperature, seasonal and sexual maturation changes. Physical damage, stress and states of disease can be detected by measurement of blood indices and histological examination. Observation of trout blood and tissue indices can be a useful procedure in management of trout cultural facilities. Timely analysis of blood and tissues may reveal nutritional deficiencies, disease and tissue damage in a population and allow essential information for the economic management.

80-002639 Lopez-Vidriero, M. T.; R. Jones; L. Reid and T. C. Fletcher. ANALYSIS OF SKIN MUCUS OF PLAICE *PLEURONECTES PLATESSA* L. *J. Comp. Pathol.* 90(3):415-420. July 1980. SFA 25(4)
[Children's Hosp. Med. Cent. 300, Longwood Ave., Boston, MA 02115]

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80-002640 MacFarlane, R. B. EFFECTS OF LOW pH WATER ON THE ADENINE NUCLEOTIDE POOL AND LOCOMOTOR ACTIVITY OF THE GULF KILLIFISH, *FUNDULUS GRANDIS*. *Ph.D. dissertation, Fla. State Univ.* 127p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(3):874. Sept. 1980. SFA 25(4)
The results of these studies suggest that environmental pH levels below 6.5 may critically impair energy metabolism and behavioral functions of fishes.--From abstr.

80-002641 Malvin, R. L.; D. Schiff and S. Eiger. ANGIOTENSIN AND DRINKING RATES IN THE EURYHALINE KILLIFISH. *Am. J. Physiol.* 239(1):R31-R34. July 1980. SFA 25(4)
[Dep. Physiol., Univ. Mich. Med. Sch., Ann Arbor 48109] Drinking rates were measured in the euryhaline fish *Fundulus heterclitus* in the presence and absence of angiotensin II or its competitive inhibitor P-113 and converting enzyme inhibitor (SQ20881). Angiotensin stimulated drinking in *Fundulus* adapted to salt- or freshwater. More significanly, P-113 decreased drinking rates in saltwater-adapted fish and to ones acutely exposed to saltwater. SQ20881 was also effective in inhibiting drinking. These data are interpreted to support the hypothesis that endogenously produced angiotensin is a physiological stimulus for drinking in fish.

80-002642 Mankura, M.; D. Dalimunthe and M. Kayama. COMPARATIVE BIOCHEMICAL STUDIES ON PLASMA CHOLESTEROL--II. RELATIONSHIP BETWEEN PLASMA ESTERIFIED CHOLESTEROL AND LECITHIN: CHOLESTEROL ACYLTRANSFERASE ACTIVITY. *Bull. Jpn. Soc. Sci. Fish.* 46(5):583-586. May 1980. SFA 25(4)
[Lab. Mar. Biochem., Fac. Appl. Biol. Sci., Hiroshima Univ., Fukuyama 720, Japan]

80-002643 Matsuno, T.; S. Nagata; M. Katsuyama; H. Matsutaka; T. Maoka and T. Akita. [COMPARATIVE BIOCHEMICAL STUDIES OF CAROTENOIDS IN FISHES--XVIII. CAROTENOIDS OF CULTURED FISHES, JAPANESE CHAR, BROOK TROUT, LAKE TROUT, MASU TROUT, RED-SPOTTED MASU TROUT, RAINBOW TROUT AND BROWN TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):473-478. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Kyoto Coll. Pharm., Misasagi, Yamashina-ku, Kyoto 607, Japan]

80-002644 Mattison, A. and B. Holstein. THE ULTRASTRUCTURE OF THE GASTRIC GLANDS AND ITS RELATION TO INDUCED SECRETORY ACTIVITY OF COD, *GADUS MORHUA* (DAY). *Acta Physiol. Scand.* 109(1):51-59. May 1980. SFA 25(4)
[Dep. Zoophysiol., Univ. Göteborg, Sweden]

80-002645 McGurk, M. D.; J. M. Green; W. D. McKone and K. Spencer. CONDITION INDICES, ENERGY DENSITY AND WATER AND LIPID CONTENT OF ATLANTIC HERRING (*CLUPEA HARENGUS HARENGUS*) OF SOUTHEASTERN NEWFOUNDLAND. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 958. iv + 41p. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Biol., Memorial Univ. Newfoundland, St. John's, NF A1B 3X9, Canada]

80-002646 Mearow, K. M. and A. H. Houston. TEMPERATURE-RELATED CHANGES IN THE CONTENT AND DISTRIBUTION OF WATER IN THE TISSUES OF RAINBOW TROUT, *SALMO GAIRDNERI*. *Comp. Biochem. Physiol. A Comp. Physiol.* 67(1):117-121. 1980. SFA 25(4)
[Dep. Biol. Sci., Brock Univ., St. Catherines, ON L2S 3A1, Canada] Water content and distribution were examined at three epaxial muscle sites and in cardiac muscle, gut, spleen, liver and brain of summer and fall-winter populations of rainbow trout acclimated to 2°, 10° and 18°C on a seasonally "neutral" photoperiod regime (12L:12D). Tissue water content tended to be conservative in terms of temperature, but seasonally variable. Tissue water distribution was more influenced by temperature. Increases in extracellular phase volume were commonly encountered at higher temperatures, and were

PHYSIOLOGY (CONTINUED)

80-002646 CONTINUED ordinarily accompanied by reduction in cellular phase volume. It is suggested that adjustments in phase volume may stem from alterations in osmotically-active organic solutes rather than inorganic electrolytes.

80-002647 Mezhnin, F. I. STANNIUS CORPUSCLES IN FISH. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):105-123. 1979. SFA 25(4)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Reg., USSR]

80-002648 Milne, R. S. STUDIES ON THE THYROID PHYSIOLOGY OF TWO SALMONID FISHES, *SALMO GAIRDNERI* AND *ONCORHYNCHUS KISUTCH. Ph.D. dissertation, Univ. Guelph (Canada)* 1979. From Diss. Abstr. Int. B Sci. Eng. 41(1):99. July 1980. SFA 25(4)

80-002649 Muramatsu, T.; S. Iwanaga and S. Kan. ISOLATION AND CHARACTERIZATION OF GLUTATHIONE REDUCTASE FROM THE DARK MUSCLE OF PACIFIC MACKEREL. *Bull. Jpn. Soc. Sci. Fish.* 46(6):757-762. June 1980. SFA 25(4)
[Lab. Fish. Chem., Fac. Fish., Nagasaki Univ., Nagasaki 852, Japan]

80-002650 Nakata, M.; M. Horiuchi and K. Kohga. [MONOLAYER CULTURE OF OVARY CELLS FROM EEL, *ANGUILLA JAPONICA*: SOME CHARACTERISTICS AND SUBCULTIVATION TECHNIQUES OF THE CELLS.] *Bull. Jpn. Soc. Sci. Fish.* 46(5):599-606. May 1980. In Japanese with English summ. SFA 25(4)
[Nihon Nosan Kogyo Co., Ltd., Res. Cent., Midori-ku, Yokohama 226, Japan]

80-002651 Ng, T. B. and D. R. Idler. GONADOTROPIC REGULATION OF ANDROGEN PRODUCTION IN FLOUNDER AND SALMONIDS. *Gen. Comp. Endocrinol.* 42(1):25-38. Sept. 1980. SFA 25(4)
[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's NF A1C 5S7, Canada]

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80-002662 CONTINUED in the control of their level are reviewed. It was shown that PFA levels in lamprey and fish depend strongly on season, circadian rhythm, nutritional state, age, sex, intrinsic activity of individuals and are regulated by some metabolites as well as hormones. The question concerning the nervous control of PFA in cyclostomes and fish needs further elucidation on account of scarce information available at present.

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[Salt Marsh Ecol., Fla. A & M Univ. Tallahassee 32307] Oxygen consumption per unit body weight of the migratory species, *Leiostomus xanthurus* and *Lagodon rhomboides*, was greater than that of

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80-002676 CONTINUED cyprinodontid and poecilid killifish species, which are permanent residents in tidal marshes. This is considered to be an inherent characteristic of the species. The routine oxygen consuption of all the species showed a conformity to changes in external oxygen tension in the range of 10-85 mmHg. While killifish showed greater dependence on ambient oxygen, the migratory species showed a lesser degree of conformity.

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[Kazakh Fish. Res. Inst., Alma-Ata, USSR] The treatment of mature spermatozoa of the carp with a combination of chemical mutagens NEU + DES in concentrations of 0.01, 0.005 and 0.0025% does not lead to a decrease in the fertilizing capacity of spermatozoa. With combined action on the spermatozoa the variability of breeding characters of the carp may be doubled, and consequently the method may be used in breeding research with pond fishes. It is essential to conduct further research on such combinations of mutagens as are capable of increasing the effectiveness of mutagenic effects on fish compared with that of individual mutagens.--Transl.

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80-002709 Taniguchi, N. and Y. Okada. [GENETIC STUDY ON THE BIOCHEMICAL POLYMORPHISM IN RED BREAM.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):437-443. Apr. 1980. SFA 25(4)
[Dep. Cult. Fish., Fac. Agric., Kochi Univ., Nankoku, Kochi 783, Japan]

80-002710 Tave, D. and R. O. Smitherman. PREDICTED RESPONSE TO SELECTION FOR EARLY GROWTH IN *TILAPIA NILOTICA*. *Trans. Am. Fish. Soc.* 109(4):439-445. July 1980. SFA 25(4)
[R. O. Smitherman: Dep. Fish. Allied Aquacult., Ala. Agric. Exp. Stn., Auburn Univ., Auburn, AL 36830]

80-002711 Turner, B. J.; R. R. Miller and E. M. Rasch. SIGNIFICANT DIFFERENTIAL GENE DUPLICATION WITHOUT ANCESTRAL TETRAPLOIDY IN A GENUS OF MEXICAN FISH. *Experimentia (Basel)* 36(8):927-930. 15 Aug. 1980. SFA 25(4)
[Dep. Biol., VPI&SU, Blacksburg, VA 24061]

BEHAVIOR

80-002712 Chauvin-Muckensturm, B. and Y. Crelet-Puterflam. SUR L'IMPORTANCE DU CONTEXTE DANS L'INTERPRETATION DES SIGNAUX CHEZ LES MÂLES DE L'ÉPINOCHE (*GASTEROSTEUS ACULEATUS*). [IMPORTANCE OF CONTEXT IN SIGNAL INTERPRETATION IN THREE SPINED STICKLEBACK MALES.] *C.R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 290(19):1273-1275. 19 May 1980. In French with English summ. SFA 25(4)
[Lab. Sociol. Anim., Univ. R.-Descartes, Chateau d'Ivoy-le-Pré, 18380 La Chapelle-d', Angillon, France]

80-002713 Crapon de Caprona, M.-O. OLFACTORY COMMUNICATION IN A CICHLID FISH, *HAPLOCHROMIS BURTONI*. *J. Comp. Ethol.* 52(2):113-136. 1980. In English with Germany summ. SFA 25(4)
[Max-Planck-Inst. Verhaltensphysiol., Seewiesen, West Germany] The responses of adult male *Haplochromis burtoni* to chemical stimuli produced by conspecifics in a reproductive state are tested. The different chemical substances presented to the test fish are described in terms of their short and long-term effects on particular behavior patterns. The responses of intact, anosmic and sham-operated fish are compared to determine whether these substances are perceived though olfaction (as opposed to gustation). Some aspects of the relative importance of visual and chemical cues from gravid females on the reproductive behavior of conspecific male *Haplochromis burtoni* are analysed.

80-002714 DiMichele, L. V. THE HATCHING MECHANISM OF *FUNDULUS HETEROCLITUS*. *Ph.D. dissertation, Univ. Del.* 134p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(1):86. July 1980. SFA 25(4)

80-002715 Elliott, C. and C. B. Schreck. STRESS AND SOCIAL HIERARCHY RANK IN COHO SALMON. *Trans. Am. Fish. Soc.* 109(4):423-429. July 1980. SFA 25(4)
[Dep. Zool., Univ. Jos, Private Mail Bag 2084, Jos, Plateau State, Nigeria]

BEHAVIOR (CONTINUED)

80-002716 Hubert, W. A. and R. T. Lackey. HABITAT OF ADULT SMALLMOUTH BASS IN A TENNESSEE RIVER RESERVOIR. *Trans. Am. Fish. Soc.* 109(4):364-370. July. 1980. SFA 25(4)
[U.S. FWS, Coop. Fish. Res. Unit, Iowa State Univ., Ames 50011]

80-002717 Imabayashi, H. [SETTLING MECHANISM OF LARVAE OF BASTARD HALIBUT, *PARALICHTHYS OLIVACEUS*, IN THE NURSERY GROUND, ESTIMATED FROM THE SIZE DISTRIBUTION.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):419-426. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Dep. Fish., Fac. Agric., Kyushu Univ. 46-04, Hakozaki, Higashi-ku, Fukuoka 812, Japan] This study was carried out to estimate the dates of settlement of larvae of the bastard halibut and to guess the mechanism how they settles on the bottom of their nursery ground in the Genkai-Nada, the Japan Sea. Four size-groups of the bastard halibut were recognized during the growing period (May to September) after their settlement, based on the shift of modes of the length in their growth curves. The dates of their settlement were estimated to be 9th and 24th of April and 7th and 22nd of May by applying Bertalanffy's growth equation to the present data. These four dates of their settlement were endorsed by field surveys of settled youngs of the bastard halibut, and almost coincide with the four spring tides during the period.

80-002718 Kaku, T.; M. Tsumagari; S. Kiyohara and S. Yamashita. GUSTATORY RESPONSES IN THE MINNOW, *PSEUDORASBORA PARVA*. *Physiol. Behav.* 25(1):99-105. July 1980. SFA 25(4)
[S. Yamashita: Biol. Inst., Coll. Liberal Arts, Kagoshima Univ., Kagoshima 890, Japan]

80-002719 Kavaliers, M. CIRCADIAN ACTIVITY OF THE WHITE SUCKER, *CATOSTOMUS COMMERSONI*: COMPARISON OF INDIVIDUAL AND SHOALING FISH. *Can. J. Zool.* 58(8):1399-1403. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] Individual and shoaling white suckers, *Catostomus commersoni*, displayed free running circadian rhythms of locomotor activity under conditions of constant darkness and temperature. The circadian activity of shoals was different from that of single fish. The activity of single fish was rhythmic initially with a period of less than 24 h, but became arrhythmic after 15-30 days. Shoals of white suckers had a less variable circadian period that was greater than 24 h, and showed no evidence of arrhythmicity. The circadian activity of shoals is determined by its behavioural and social organization; it is not simply a more precise version of the activity of single fish.

80-002720 Kavaliers, M. CIRCADIAN RHYTHM IN THE EFFECT OF THEOPHYLLINE ON THE BEHAVIORAL THERMOREGULATION OF THE WHITE SUCKER, *CATOSTOMUS COMMERSONI*. *Pharmacol. Biochem. Behav.* 13(6):843-845. June 1980. SFA 25(4)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] The temperatures selected by white suckers placed in a thermal gradient were significantly altered by interperitoneal injections of theophylline (25 mg/kg). There was a circadian variation in the effect of theophylline on temperatures selected by individual fish held under constant illumination. Depending on injection time, there was either a significant increase or significant decrease in the temperatures selected. These results are considered in relation to the possible physiological and biochemical effects of theophylline on thermoregulation and circadian rhythms.

80-002721 Konstantinova, E. G.; I. D. Bilkei'shii and L. S. Tarasov. ACOUSTIC AND ELECTRIC ACTIVITY OF TILAPIA *MOSSAMBICA* (CICHLIDAE, PISCES). *Vestn. Mosk. Gos. Univ., Ser. 6, Biol. Pochv.* 34(2):55-59. 1979. SFA 25(6)
[Moscow Univ., Moscow, USSR]

BEHAVIOR (CONTINUED)

80-002722 Marliave, J. B. SURVIVAL THROUGH METAMORPHOSIS OF PACIFIC HERRING PREVENTED FROM SCHOOLING. *Trans. Am. Fish. Soc.* 109(3):327-328. May 1980. SFA 25(4)
[Vancouver Public Aquarium, P.O. Box 3232, Vancouver, BC V6B 3X8, Canada]

80-002723 McElman, J. F. and E. K. Balon. EARLY ONTOGENY OF WHITE SUCKER, *CATOSTOMUS COMMERSONI*, WITH STEPS OF SALTATORY DEVELOPMENT. *Environ. Biol. Fishes* 5(3):191-224. 29 Sept. 1980. SFA 25(4)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Frequent and detailed observatoins of arbitrary stages revealed a saltatory pattern of development in the early ontogeny of fluvial spawning white sucker. Considered as adaptations for respiration were: i) expansion of the surface area of the yolk through a change in yolk shape, ii) the presence of carotenoid pigment in the yolk, iii) a large caudal vein sinus, iv) coverage of the yolk surface with capillaries of bilaterally paired vitelline plexi, and v) a large pair of vitelline veins. The ability to swim developed slowly and well after hatching. Young suckers would therefore spend most of the eleutheroembryonic phase in the interstices of the rock substrate of the spawning ground. The change from a benthic to pelagic mode of existence occurred with swimbladder inflation and before the start of exogenous feeding.

80-002724 Mochek, A. D. [BEHAVIOUR OF FISHES IN THE COASTAL ZONE OF THE BLACK SEA.] *Zool. Zh.* 59(7):1060-1066. July 1980. In Russian with English summ. SFA 25(4)
[Inst. Anim. Evol. Morphol. Ecol., USSR Acad. Sci., Moscow, USSR]

80-002725 Nashimoto, K. [THE SWIMMING SPEED OF FISH IN RELATION TO FREQUENCY OF TAIL BEATING AND BODY TYPE.] *Bull. Jpn. Soc. Sci. Fish.* 46(6):675-679. June 1980. In Japanese with English summ. SFA 25(4)
[Fac. Fish., Hokkaido Univ., Minato-Cho, Hakodate 041, Japan]

80-002726 Radakov, D. V.; A. D. Mochek; Yu. N. Shikin and A. S. Lee. THE INTERRELATIONSHIP BETWEEN GROUP BEHAVIOR AND OTHER BIOLOGICAL CHARACTERISTICS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):167-171. 1979. SFA 25(4)
[A. N. Severtsov Inst. Evol. Morphol. Anim. Ecol., USSR Acad. Sci., Moscow, USSR]

80-002727 Reynolds, W. W. and M. E. Casterlin. THERMOREGULATORY BEHAVIOR OF A TROPICAL REEF FISH, *ZEBRASOMA FLAVESCENS*. *Chaos* 24(3):356-358. May 1980. In English with Russian summ. SFA 25(4)
Ten Hawaiian "Laipala" surgeonfish (Acanthuridae), *Zebrasoma flavescens* (Bennett), were tested individually in electronic "ichthyotron" shuttleboxes for ability to thermoregulate behaviorally. The fish exhibited a diel rhythm of preferred temperature, with a minimum of 19°C at midnight and a maximum of 29°C at noon. The 24-h mean final thermal preferendum was 25°C, similar to the final preferenda of temperate "cool-water" fishes. The similar thermoregulatory behavior of tropical marine and temperate freshwater fishes suggests that thermoregulatory ability is phylogenetically conservative and not strongly influenced by thermal stability of the environment.

80-002728 Robbins, A. J.; A. C. Marsh; D. Marsh and D. J. Sharp. PARENTAL BEHAVIOUR AND BREED SHOALS AMONG CICHLID FISH OF LAKE MALAWI. *S. Afr. J. Zool.* 15(1):1-6. 1980. In English with Afrikaans summ. SFA 25(4)

BEHAVIOR (CONTINUED)

80-002728 CONTINUED
[JLB Smith Inst. Ichthyol., Rhodes Univ., Grahamstown, South Africa] The number of species of cichlid found to host foreign offspring in mixed broods in Lake Malawi is much greater than originally supposed. It is suggested that all species which show well developed parental behaviour may have foreign fry mix with their broods on occasion. A variety of species of fry were found in mixed broods. These come from two categories of fish: those which apparently do not guard their free swimming fry, and those which have a well entrenched phase of protective care. Although substrate spawners may encourage other fry to join their broods it is argued that foreign young are unwelcome guests of mouthbrooders.

80-002729 Stevens, J. K. and K. E. Parsons. A FISH WITH DOUBLE VISION. *Nat. Hist.* 89(1):62-67. Jan. 1980. SFA 25(4)
[Playfair Neurosci. Lab., Univ. Toronto, Canada]

80-002730 Trump, C. L. and W. C. Leggett. OPTIMUM SWIMMING SPEEDS IN FISH: THE PROBLEM OF CURRENTS. *Can. J. Fish. Aquatic Sci.* 37(7):1086-1092. July 1980. SFA 25(4)
[Appl. Hydrodynamics Lab., Code 4310, Naval Res. Lab., Washington, DC 20375]

80-002731 Tsvetkov, V. I. and A. N. Danilov. REACTIONS OF THE ROACH, *RUTILUS RUTILUS*, THE MINNOW, *PHOXINUS PHOXINUS*, AND THE "VERKHOVKA", *LEUCASPIUS DELINEATUS*, TO CHANGES IN THEIR BUOYANCY. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):136-141. 1979. SFA 25(4)
[A.N. Severtsov Inst. Evol. Morphol. Anim. Ecol., USSR Acad. Sci., Moscow, USSR] The buoyancy of cyprinid fishes is variable; it may be neutral, negative or positive. With negative buoyancy, the fish swallow air from the surface of the water and fill their gas bladder to the necessary volume (compression). With positive buoyancy, excess gas is discharged from the bladder through the mouth in the form of individual bubbles (decompression). Recording of the latent period of these hydrostatic reactions, their duration and intensity showed the dependence of their manifestation on a number of factors. Under experimental conditions decompression is manifested more rapidly and is more intensive in fish than compression. Species differences in the manifestation of hydrostatic reactions are indistinctly expressed in the minnow, *Phoxinus phoxinus*, the roach, *Rutilus rutilus*, and the "verkhovka", *Leucaspius delineatus*.

80-002732 Webb, P. W. and G. R. Smith. FUNCTION OF THE CAUDAL FIN IN EARLY FISHES. *Copeia* 1980(3):559-562. 6 Sept. 1980. SFA 25(4)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

80-002733 Webb, P. W. and J. M. Skadsen. STRIKE TACTICS OF *ESOX*. *Can. J. Zool.* 58(8):1462-1469. Aug. 1980. In English with French summ. SFA 25(4)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Strike tactics of a lunging piscivore attacking solitary prey were observed in an arena 50 cm long, 50 cm wide, and 10 cm deep and recorded on television video tape. The predators were cultured tiger musky (*Esox* sp.). The prey were fathead minnow (*Pimephales promelas*). Predator strikes were S type fast starts allowing multidirectional attacks. Two strike patterns were observed. Pattern A strikes commenced from a stretched-straight body posture and progressed from fast start stage 1 through the normal three-stage sequence. Pattern B strikes deleted the less efficient first stage, starting acceleration from an S posture. Strikes were directed in the vicinity of the center of mass of the prey, the point that moves least during escape attempts. Prey were usually attacked from the side, minimizing the displacement of the prey from the strike path after an escape attempt. Pattern A strikes were launched over

BEHAVIOR (CONTINUED)

80-002733 CONTINUED distances from 3.8 to 33.9 cm and took 50-300 ms. Catch success was 42%. Pattern B strikes were used for short distances from 1.7 to 7.7 cm, taking 17-100 ms and were 95% successful. The observed strike tactics were those expected to maximize the probability of catching elusive fish prey.

80-002734 Weihs, D. RESPIRATION AND DEPTH CONTROL AS POSSIBLE REASONS FOR SWIMMING OF NORTHERN ANCHOVY, *ENGRAULIS MORDAX*, YOLK-SAC LARVAE. *NOAA Fish. Bull.* 78(1):109-117. 1980. SFA 25(4)

[Dep. Aeronaut. Eng., Technion, Haifa, Israel] Larval nothern anchovy in the yolk-sac (nonfeeding) stage exhibit regular bursts of continuous swimming during the first 3 days after hatching. It has been suggested that this behavior may have a respiratory function. A different possibility is depth control, countering the tendency of the larvae to sink when motionless. This paper includes a theoretical and experimental investigation of the possible functions of these swimming bouts. The theoretical approach was to define a model and calculate the oxygen available to the larvae when resting and while moving, and experiments were performed as a check of the theoretical results. The experiments were conducted on yolk-sac larvae in sealed tanks with varying dissolved oxygen concentrations to determine the effects of reducing the available oxygen on the frequency and duration of the swimming bursts. Results of the experiments confirmed the theoretical model. They indicate that the swimming bouts both help the larva stay at a constant depth and have a respiratory function when the oxygen concentration in seawater is less than 60% of saturation.

LIFE HISTORY-GENERAL WORKS

80-002735 Balon, E. K., (ed.) CHARRS: SALMONID FISHES OF THE GENUS *SALVELINUS*. *Perspect. Vert. Sci. (Dr. W. Junk bv Publ.)* 1:1-928. Apr. 1980. Available @ $210.60 from Kluwer Boston, Inc., 160 Old Derby St., Hingham, MA 02043. SFA 25(4)

This work is an anthology of reviews and original studies by the world's leading experts of current knowledge about charrs. The evolution of charrs in many aspects parallels the evolution of man. The charrs evolved from more specialized, planktonophagous ancestors of a warm climate, into paedomorphic, less specialized, eternal juveniles, as did man from their pithecine ancestors into neotenic hominids. The neotenic charrs were able to invade the most inhospitable habitats; so were neotenic men. Salmonid fishes are the subject of more published work than any other fishes. This is influenced by the fact that salmonids share their environment with a group of hominids that up to now have produced most of the world literature. It is certainly not a reflection of the food or sport value of salmonids for the whole of mankind. But the significance of charrs, as of many other organisms, may be in more than just their usefulness to man. This book attempts to demonstrate this at least in part.

80-002736 Barton, B. A. SPAWNING MIGRATIONS, AGE AND GROWTH, AND SUMMER FEEDING OF WHITE AND LONGNOSE SUCKERS IN AN IRRIGATION RESERVOIR. *Can. Field-Nat.* 94(3):300-304. July-Sept. 1980. SFA 25(4)

[Fish. Br., Minist. Nat. Resour., Queens's Park, Toronto, ON M7A 1W3, Canada] During the upstream spawning migration in spring 1978 of suckers into an irrigation reservoir diversion canal, the best correlation was between movement and 'stream temperature X discharge.' White Suckers (*Catostomus commersoni*) remained in the canal longer than Longnose Suckers (*C. catostomus*), and males of both species remained longer than females. The rates of White and Longnose Suckers returning downstream were 52.4% and 59.2% respectively, indicating high mortality, possibly from predation during spawning. Minimum age of spawning was 5+ for males and 6+ for females of

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002736 CONTINUED White Suckers, and 4+ for males and 5+ for females of Longnose Suckers. In the lake, both species approached maturity at age 2 in males and age 3 in females. Annual growth in females was greater than in males after the age of first spawning. Cladocerans, mostly *Daphina*, were major food items in the reservoir during the summer 1977, being 33.7% of White Sucker diet and 74.2% of Longnose Sucker diet over a 4-mo period. Tendependidae were more important for White Suckers, contributing 21.0% of their food volume compared to 4.7% of food volume in Longnose Suckers. Feeding selectivity for *Daphina* by both sucker species was apparent.

80-002737 Bayer, R. D. SIZE, SEASONALITY, AND SEX RATIOS OF THE BAY PIPEFISH (*SYNGNATHUS LEPTORHYNCHUS*) IN OREGON. *Northwest Sci.* 54(3):161-167. Aug. 1980. SFA 25(4)

[423 SW 9th, Newport, OR 97365] Bay pipefish (*Syngnathus leptorhynchus*) captured in the Yaquina estuary, Oregon, ranged from 6.8 to 38.5 cm TL and from less than 0.2 to 20.3 g net weight. Most (63 percent) pipefish weighed less than 1.5 g. Females were proportionately longer than males. The length-weight relationship was log W = -3.70 + 3.12 log TL (cm). The greatest observed density was 0.10 pipefish/m^2; densities were greater during daylight than darkness. The sex ratio prior to and during the breeding season was as great as 4 females: 1 male for those longer than 17.0 cm TL, but apparently the sex ratio is inadequate to determine if males are ever in short supply. The breeding season extended from February to at least July. *Syngnathus leptorhynchus* were present throughout the year but were most abundant from December through May. In June, most pipefish emigrated away from the study area and may have moved up the estuary.

80-002738 Druzhinin, A. D. and N. A. Filstova. SOME DATA ON CROAKERS (FAMILY SCIAENIDAE) OF THE GULF OF ADEN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):149-151. 1979. SFA 25(4)

[VNIRO, Moscow, USSR] No less than 8 species of croakers inhabit the area off the south-east coast of the Arabian Peninsula: *Otolithes ruber, Atractoscion aequidens, Argyrosomus argentatus, A. marleyi, Protonibea deacanthus, Dendrophysa dussumieri, Umbrina capensis* and *U. sinuata*. In this region croakers live at depths of less than 100 m where the bottoms include sand in their composition or are stony. The largest size was noted in *A. aequidens* (68-86 cm) and *A. marleyi* (45-88 cm) the smallest in the red croaker *O. ruber* (22-41 cm). Larger red croaker specimens inhabit the Cape Fartak area than the Aden area. The age of the red croaker varied from 1+ to 4+ years.--Concl.

80-002739 Glazier, J. R. and C. A. Taber. REPRODUCTIVE BIOLOGY AND AGE AND GROWTH OF THE OZARK MINNOW, *DIONDA NUBILA*. *Copeia* 1980(3):547-550. 6 Sept. 1980. SFA 25(4)

[Dep. Life Sci., Southwest Mo. State Univ., Springfield 65802]

80-002740 Hunter, J. R. and C. A. Kimbrell. EARLY LIFE HISTORY OF PACIFIC MACKEREL, *SCOMBER JAPONICUS*. *NOAA Fish. Bull.* 78(1):89-101. 1980. SFA 25(4)

[NMFS, P.O. Box 271, La Jolla, CA 92038] The early life history of Pacific mackerel, *Scomber japonicus*, is described from laboratory-rearing studies and examination of stomach contents of sea-caught larvae. At 19°C mackerel eggs hatched in 56 hours, larvae were 3.1 mm standard length with a dry weight of 0.04 mg of which 50% was yolk. First feeding occurred 46 hours after hatching; all larvae fed by 60 hours (age 2.5 days). Larvae were then 3.6 mm long with fully pigmented eyes and 10% of the yolk remaining. Starvation was irreversible if larvae were not fed before age 4.5 days. Metamorphosis (15 mm standard length) occurred in 26 days at 16.8°C to 16 days at 22.1°C. Larvae 3-5 days old consumed 67% of their body weight per day and had a mean gross growth efficiency in dry weight of 33%. Oxygen consumption was 6.1µl O_2 per milligram dry weight per hour at

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002740 CONTINUED 18°C and 11.4µl O_2 per milligram dry weight per hour at 22°C. Swimming speeds ranged from 1.3 standard lengths per second for first-feeding larvae to 3.8 standard lengths per second for fish at metamorphosis. Fifty percent of the larvae were able to capture a prey when the width of the prey was 85% of the width of the mouth and 95% were able to do so when the prey was 57% of the width of the mouth. Cannibalism was common in rearing groups; at 8 mm standard length, 50% of the larvae became capable of feeind on other fish larvae and cannibalism ceased when schooling commenced. Chief food items of sea-caught larvae were stages of copepods; maximum food width increased rapidly with larval length and was equivalent to the maximum mouth width. Mean prey width was 38% of mouth width. The larger organisms, constituting half of the prey eaten, accounted for 85-90% of the total volume of food eaten.

80-002741 Kubo, T. [STUDIES ON THE LIFE HISTORY OF THE "MASU" SALMON (*ONCORHYNCIUS MASOU*) IN HOKKAIDO.] *Sci. Rep. Hokkaido Salmon Hatchery* No. 34. p. 1-95. Mar. 1980. In Japanese with English summ. SFA 25(4)
[Nanae Fish.-Cult. Exp. Stn., Fac. Fish., Hokkaido Univ., Nanae, Hokkaido, Japan]

80-002742 Nemecek, R. J. THE COMPARATIVE ECOLOGY OF THREE SPECIES OF DARTERS IN THE GENUS *ETHEOSTOMA: ETHEOSTOMA VARIATUN* (KIRTLAND), *ETHEOSTOMA CAERULEUM* (STORER), AND *ETHEOSTOMA ZONALE* (COPE) IN THE ALLEGHENY RIVER DRAINAGE OF WESTERN NEW YORK. *Ph.D. dissertation, Saint Bonaventure Univ.* 175p. 1980 From Diss. Abstr. Int. B Sci. Eng. 41(2):491. Aug. 1980. SFA 25(4)
The distribution and comparative ecology of three species of darters, *Etheostoma variatum* (Kirtland), *E. caeruleum* (Storer), and *E. zonale* (Cope), were studied in the Allegheny River drainage of western New York. *E. caeruleum* was found to have the most extensive distribution and ascends the upstream portions of the larger creeks and tributaries to a greater extent than either *E. variatum* or *E. zonale*. *E. zonale* is is abundant wherever it is collected, but *E. variatum* is far less abundant due to the lack of suitable riffle habitat throughout the drainage. Preferences for water temperature, current velocities, water depth, vegetative covering, and substrate compositon were found to vary among the three species. *E. variatum* prefers riffles with fast current velocities and a bottom substrate composed of large cobble or boulder. *E. caeruleum* can be found in a variety of habitats ranging from moderately fast riffles to slow moving runs and pools. *E. zonale* prefers riffles with moderately fast current velocities and avoids the deeper, faster riffles as well as the deeper runs and pools. *E. zonale* is found in greater numbers in the riffles containing some vegetative covering. The lengths of the spawning seasons and the peak spawning periods in western New York were determined for all three species. The spawning seasons overlap and the same riffles may be used by all three darters for reproductive purposes. However, there appears to be little competition for spawning habitat. Observations on the reproductive behavior of *E. caeruleum* and *E. zonale* were made in the field during the study. Seasonal and daily feeding habits varied significantly among the three species and reduced competeition. In addition, the reliance upon some very abundant food sources such as the Chironomidae reduces any competition even further. In general, a sufficient amount of resource partitioning was found to exist and allows these three sympatric species to coexist in the riffle habitat.

80-002743 Ogasawara, Y. and T. Kawasaki. LIFE HISTORY OF MIGIGAREI, *SCIAENA ARKUZENIUS* (JORDAN ET STARKS), IN SENDAI BAY, WITH SPECIAL REFERENCE TO SEXUAL DIMORPHISM. *Tohoku J. Agric. Res.* 30(4):163-182. Mar. 1980. SFA 25(4)
[Dep. Fis. Sci., Fac. Agric., Tohoku Univ., Sendai, Japan] Migigarei are caught by the small trawlers in the 100-300 meters deep area and the catches

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002743 CONTINUED are especially abundant in the area 135-150 meters deep. The asymptotic body length of Bertalanffy's growth equation is from 16.4 to 18.4 cm in the male and 22.3-25.3 cm in the female. The maximum age is 9 years in the male and 13 years in the female among all the fish sampled. The maximum GSI is about 2 percent in the male and 30 per cent in the female. The spawning period is from late October to late January, with its peak in November to December. A female spawns several times in one spawning season. The regression of fecundity (F) on body length (BL) in cm is shown as $F=4.819BL^{3.618}$. The biological minimum size is 11.5 to 12.5 cm in the male and 13.5 to 15.0 cm in the female. Two years old individuals of both sexes that grow fast participate in spawning. The age when all the individuals spawn is 3 years in the male and 4 years in the female. *Ophiura* and polichaete are the major food of migigarei. In mature female annual change is observed in ovary-free body weight, liver weight, food intake, GSI and incidence of individuals with translucent zone at the periphery of otolith. The marked feature in the life history of migigarei is the conspicuous sexual dimorphism. In the case of females, the average length at a given age, maximum length, longevity, age at first maturing and GSI have considerably higher values than those of males. Sexual differences are observed more or less in the littoral or dermersal species, whereas in the fishes migrating in the surface or subsurface layers the difference in development or growth between sexes are small. The sexual differences are recognized as a strategy of littoral or demersal fishes to increase the egg number by means of allocating more resources to the female. Migigarei exhibit especially marked sexual differences among heterosomes. Migigarei feed on *Ophiura* of low calorid value and inhabit an especially adverse and poor environment. In these conditions it is supposed that the migigarei have selected a survival strategy to maximize the intersexual differences.

80-002744 Peterson, R. H.; R. H. Johansen and J. L. Metcalfe. OBSERVATIONS ON EARLY LIFE STAGES OF ATLANTIC TOMCOD, *MICROGADUS TOMCOD. NOAA Fish. Bull.* 78(1):147-158. 1980. SFA 25(4)

[Fish. Oceans Can., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] In southern New Brunswick, tomcod spawn in streams from late December to mid-January. The benthic eggs hatch and newly hatched larvae drift to sea in mid-March to mid-April at which time ocean temperatures are beginning to increase. Larval migration to sea is probably aided by active swimming of larvae to the surface to fill the swim bladder, which must be filled within 24 hours of hatching. Photopositivity of the larvae may assist in guiding larvae to the surface. Water content and specific gravity of eggs reared in 0 °/oo were 2.8 mg and 1.030. Eggs reared at 10-30 °/oo had about 2.3 mg water per egg. Specific gravity of eggs incubated in 10 °/oo was constant for 27 days (at 2°-4°C) at 1.038, then decreased to 1.033. This decrease is associated with water uptake of 0.5-0.6 mg per egg and elimination of salt. The specific gravity of eggs incubated in 20 °/oo declined linearly from 1.044 to 1.037, associated with accumulation of 0.2 mg of water and elimination of greater salt load. The specific gravity of eggs incubated at 30 °/oo declined linearly from 1.049 to 1.045, associated with 0.1 mg water uptake and apparently insufficient salt elimination. Water uptake and salt excretion problems are minimized for eggs reared in freshwater, and under the experimental conditions described here. Normal development could not occur in continued exposure to 30 °/oo. In natural spawning areas, the incubation medium is freshwater for most of the total cycle, with seawater invading the area only at extreme high tide. The salinity tolerance of tomcod eggs is compared with that of freshwater and marine fish eggs in general. Calculation of specific gravity of egg solids may prove a useful indirect way to investigate salt regulation in fish eggs.

80-002745 Rinne, J. N. NOTES ON THE OCCURRENCE AND BIOLOGY OF *XENOCLARIAS* GREENWOOD (SILURIFORMES: CLARIIDAE) IN LAKE VICTORIA, EAST AFRICA. *J. Nat. Hist.* 14(4):579-587. July-Aug. 1980. SFA 25(4)

[Rocky Mtn. For. Range Exp. Stn., Ariz. State Univ., Tempe 85281]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002746 Rupprecht, R. J. and L. A. Jahn. BIOLOGICAL NOTES ON BLUE SUCKERS IN THE MISSISSIPPI RIVER. *Trans. Am. Fish. Soc.* 109(3):323-326. May 1980. SFA 25(4)
[1903 Overdene Ave., Rockford, IL 61103]

80-002747 Setzler, E. M.; W. R. Boynton; K. V. Wood; H. H. Zion; L. Lubbers; N. K. Mountford; P. Frere; L. Tucker and J. A. Mihursky. SYNOPSIS OF BIOLOGICAL DATA ON STRIPED BASS, *MORONE SAXATILIS* (WALBAUM). *NOAA Tech. Rep. NMFS Circ.* 433. vi + 69p. June 1980. SFA 25(4)
[Univ. Md. CEES, Chesapeake Biol. Lab., Box 38, Solomons 20688]

80-002748 Stewart, D. D. A PRELIMINARY STUDY OF THE BIOLOGY OF THE STURGEON CHUB (*HYBOPSIS GELIDA*) IN THE POWDER RIVER IN WYOMING. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:38-41. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[Box 15, Dep. Zool., Univ. Wyo., Laramie 82071] A study of the distribution and biology of the sturgeon chub, *Hybopsis gelida*, in the Powder River in northern Wyoming was conducted in 1979. Due to concern that the native range of this cyprinid has rapidly decreased, the habitat, feeding, reproduction and distribution were examined in detail. Habitat requirements such as water velocity, depths, substrate composition and positioning in the habitat were noted. Feeding behavior and preferred food sources were determined. This study disclosed that a stable population of sturgeon chubs exists in the Powder River from the mouth of Salt Creek in southeastern Johnson County to the Montana border in Wyoming. The sturgeon chub appears to have disappeared from the North Platte and Big Horn Rivers where it had previously been collected.

80-002749 Taubert, B. D. BIOLOGY OF SHORTNOSE STURGEON (*ACIPENSER BREVIROSTRUM*) IN THE HOLYOKE POOL, CONNECTICUT RIVER, MASSACHUSETTS. *Ph.D. dissertation, Univ. Mass.* 149p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(3):794. Sept. 1980. SFA 25(4)

80-002750 Tuunainen, P. HARJUKSEN, *THYMALLUS THYMALLUS* (L.) KASVU RAVINTO JA KANNAN IKÄRAKENNE NÄÄTÄMÖNJOEN VESISTÖN LATVAOSISSA. [THE GROWTH, FOOD AND AGE OF GRAYLING, *THYMALLUS THYMALLUS* (L.), FROM THE UPPER PART OF THE NÄÄTÄMÖNJOKI RIVER SYSTEM.] *Suom. Kalatalous* No. 48. p. 5-20. 1978. In Finnish with English summ. SFA 25(4)
[Riista-ja Kalatalouden Tutkimuslaitos, Kalantutkimuosasto PL 193, 00131 Hesinki 13, Finland] This study is part of a fisheries investigation on the Näätämönjoki river system in NE Lapland. The material examined from the River Vaijoki, which flows into Lake Iijärvi, the central lake of the Näätämönjoki system. The Vaijoki is in an almost natural state. Its length is about 27 km. Its upper course lies 259 m above sea level in the upper part of the fjeld birch zone. Lake Iijärvi is located in the fjeld birch zone at an altitude of 193 m. The total area of the Vaijoki is 71 ha, and 15 ha consists of rapids. Data are given on the water quality, temperature and rate of flow. In addition to grayling, the river contains whitefish, brown trout, burbot, pike, perch, ten-spined sticklebacks and minnows. The fishing intensity is very low. The material consisted of 57 grayling caught during 11--15.8. 1972 with gillnets and by angling. It was compared with 133 grayling collected by the same methods in 1956 and during 1970-1973 from the upper and middle course of the Ivalojoki, which flows into Lake Inarinjärvi, and from one of its tributaries, from the upper part of the Näätämöjoki and from the Kaldoutsjoki, which flows into Lake Pulmankijärvi. In addition, 14 grayling were collected in 1972 from an area of 300 m^2 in the Näätämöjoki, which flows into Lake Iijärvi. The average growth rate of grayling in the Vaijoki proved to be slow compared with the rate in more southern regions, although it is similar to that in populations with a low fishing intensity in the same climatic zone. A feature

LIFE HISTORY-GENERAL WORKS (CONTINUED)

80-002750 CONTINUED of the grayling population in the River Vaijoki not found in neighbouring rivers is a high frequency of over ten-year-old fish. This longevity compensates for the low growth rate of the grayling in the Vaijoki, and they reach, or even exceed, the maximum size of over 1 kg achieved by grayling in more southern waters. Their diet is similar to that of grayling in other northern rivers. The growth rate did not show the clear decrease after the age of 6-8 years which is often observed elsewhere, and this may possibly be due to the presence of fish in the grayling diet. Comparison of the present results with information from other areas where the European grayling is found indicates that slow growing northern individuals often reach a greater age and a larger maximum size than the fast growing individuals of southern populations. Thermal and other climatic factors may possibly contribute to their longevity. Not all the grayling populations with low growth rates contain old fish, and, conversely, some populations with individuals with high growth rates include rather old grayling. A possible reason for this may be differences in fishing intensity.

80-002751 Zaret, T. M. LIFE HISTORY AND GROWTH RELATIONSHIPS OF *CICHLA OCELLARIS*, A PREDATORY SOUTH AMERICAN CICHLID. *Biotropica* 12(2):144-157. June 1980. In English with Spanish summ. SFA 25(4)

[Dep. Zool., Inst. Environ. Stud. FM-12, Univ. Wash., Seattle 98195] This paper examines the life history and growth relationships of *Cichla ocellaris*, a predatory South American cichlid. Data from extensive field studies in Gatun Lake, Panamá, where *C. ocellaris* was introduced, present a complete life history for this species from pair formation through parental care of the young. These data are relevant to fish management and culture efforts, since *C. ocellaris* is one of the few New World cichlid species which is exploited commercially. New interpretations of the evolution of parental care patterns in cichlids, and the possible significance of latitudinal differences in parental care patterns among guarders, are included. Creel surveys allow comparison of length/weight ratios from native habitats in Brazil and Venezuela, non-native habitats in Panamá and Hawaii, and non-native riverine habitats in Panamá. These results indicate that the pontential for long-term continuous harvest, it is greater in rivers.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-002752 Kaeding, L. R. OBSERVATIONS ON COMMUNITIES OF BROOK AND BROWN TROUT SEPARATED BY AN UPSTREAM-MOVEMENT BARRIER ON THE FIREHOLE RIVER. *Prog. Fish-Cult.* 42(3):174-176. July 1980. SFA 25(4)

[U.S. FWS, 2700 N. 4th St. Suite E-1, Flagstaff, AZ 86001]

80-002753 Kawamura, H. [DISTRIBUTION, MOVEMENT AND AGE CONSTITUTION OF THE COMMON FRESHWATER SCULPIN (*COTTUS POLLUX* GÜNTHER) IN THE SALMON PROPAGATION RIVER.] *Sci. Rep. Hokkaido Fish Hatchery* No. 34. p. 17-24. Dec. 1979. In Japanese with English summ. SFA 25(4)

[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan]

80-002754 Kojima, H. and K. Sugiwaka. [THE GROWTH, INDIVIDUAL DENSITY AND STANDING CROP OF JUVENILE MASU SALMON IN THE ATSUTA RIVER, HOKKAIDO.] *Sci. Rep. Hokkaido Fish Hatchery* No. 34. p. 7-16. Dec. 1979. In Japanese with English summ. SFA 25(4)

[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan] The growth, individual density and standing crop of juvenile masu

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

80-002754 CONTINUED salmon (*Oncorhynchus masou*) caught with casting nets, in order to promote the propagation of fish resources, were examined at three stations (pools) in the Atsuta River, Hokkaido, from July to October, 1978. The juveniles grew almost straightly from 6.5 to 10.1 cm in fork length during three months from July to October. The greater part of the fish population was occupied by fish of 6-7 cm in fork length in July, 8-9 cm in September, and two groups of 9-10 and 11-12 cm in October. It was considered that phase differentiation of the juveniles appeared in October. The individual density of juveniles, determined by marking method and removal method, changed scarcely (0.46-0.53/m^2). The standing crop of juveniles increased almost straightly and reached the maximum of 5.80 g (w.w.)/m^2 in October, showing the rise of 3.87 g (w.w.)/m^2 during 85 days. From these results, it is considered that the Atsuta River has the capability to produce enough feed to maintain greater amounts of juvenile masu salmon than those in now.

80-002755 Watt, W. D. and G. H. Penney. JUVENILE SALMON SURVIVAL IN THE SAINT JOHN RIVER SYSTEM. *Can. Dep. Fish. Oceans Tech. Rep.* No. 939. viii + 13p. May 1980. In English with French summ. SFA 25(4)

[Dep. Fish. Oceans, Halifax, NS B3J 2S7, Canada] For the Saint John River system above Mactaquac Dam the number of actual virgin returns per female salmon spawner rose from 10 (per 8,000 eggs) for spawning year 1967 to a peak of 16 for 1969 and then declined to 3 for 1972. Most returns were in the fourth, fifth and sixth years after spawning. This rise and decline is attributed to a combination of poor juvenile survival (due to pollution) in the main stem of the Saint John River and to changes in the relative proportions of spawning adults released into the main stem and into the Tobique River (a tributary). The adult return average for salmon spawners in Tobique River was high (16.8 per 8,000 eggs), while for fish released into the main stem (Woodstock) and not migrating to the Tobique, the return rate was not significantly greater than zero (2.8 per 8,000 eggs). To maximize the number of wild salmon returns, it is recommended that the first priority should be to ensure an adequate egg-deposition density in Tobique River.

80-002756 Wilk, S. J.; W. G. Smith; D. E. Ralph and J. Sibunka. POPULATION STRUCTURE OF SUMMER FLOUNDER BETWEEN NEW YORK AND FLORIDA BASED ON LINEAR DISCRIMINANT ANALYSIS. *Trans. Am. Fish. Soc.* 109(3):265-271. May 1980. SFA 25(4)

[NMFS, Sandy Hook Lab., Highlands, NJ 07732]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

80-002757 Alekseyeva, Ye. I. and I. D. Tormosova. MATURATION, SPAWNING AND FECUNDITY OF THE NORTH SEA HADDOCK, *MELANOGRAMMUS AEGLEFINUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):56-64. 1979. SFA 25(4)

[AtlantNIRO, Kaliningrad, USSR]

80-002758 Chan, E. H. and T. E. Chua. REPRODUCTION IN THE GREENBACK GREY MULLET, *LIZA SUBVIRIDIS* (VALENCIENNES, 1836). *J. Fish Biol.* 16(5):505-519. May 1980. SFA 25(4)

[Fac. Fish. Mar. Sci., Univ. Agric. Malaysia, Serdang, Seangor, Malaysia] This paper presents data on the reproductive biology of *Liza subviridis*, a little studied mullet species. The fish is heterosexual, exhibiting external fertilization. Six maturity stages can be macroscopically identified in the testes and seven in the ovaries. The macroscopic changes in the gonads are manifestations of histological changes occurring in the development of

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002758 CONTINUED sperm cells and oocytes. First sexual maturity is attained in the length ranges of 9.5-11.5 cm and 10.5-11.5 cm in male and female fish respectively. The fecundity for fish measuring 10.3-13.9 cm in standard length ranged from 40,000-145,000 eggs. The relationship between fecundity (F) and length (L) can be represented as: $F=1.9044\ L^{4.2998}$. The spawning duration in *L. subviridis* is restricted to a short and definite period, with all ripe ova being released within a single spawning act. A pronounced spawning season can be detected to extend from June to November. However, during off-seasons, some spawning also occurs. The correlations between spawning, rainfall and air temperature is discussed.

80-002759 Curry, K. D. USE OF A WABASH RIVER TRIBUTARY FOR SUCKER (CATOSTOMIDAE) REPRODUCTION. *Ph.D. dissertation, Purdue Univ.* 110p. 1979. From Diss. Abstr. Int. B Sci. Eng. 41(1):54. July 1980. SFA 25(4)

80-002760 De Silva, S. S. and J. Chandrasoma. REPRODUCTIVE BIOLOGY OF *SAROTHERODON MOSSAMBICUS*, AN INTRODUCED SPECIES, IN AN ANCIENT MAN-MADE LAKE IN SRI LANKA. *Environ. Biol. Fishes* 5(3):253-259. 29 Sept. 1980. SFA 25(4)

[Dep. Zool., Ruhuma Univ. Coll., Matara, Sri Lanka] The reproductive biology of *Sarotherodon mossambicus* (Peters), a species exotic to Sri Lanka, was studied in Parakrama Samudra -- an ancient man-made lake. Females outnumbered males by approximately 2 to 1, but the predominance of females tended to decrease with increasing size. Males mature at a length of 27.5 cm and females at a length less than 15.0 cm. *S. mossambicus* breeds throughout the year with four possible peak periods, which coincide with the tailend of the monsoon and intermonsoon rains. The egg diameter distribution indicates the presence of reserve oocytes and yolked oocytes, the latter falling into a single mode between 1.2 to 3.6 mm. Fecundity varied between 360 and 1775 for fish ranging in length from 20.0 to 31.9 cm and 145 to 538 g in weight. The diameter of nests increased with depth up to 60-65 cm. Nests were not found in depths over 90 cm.

80-002761 Downhower, J. F. and L. Brown. MATE PREFERENCES OF FEMALE MOTTLED SCULPINS, *COTTUS BAIRDI*. *Anim. Behav. (Bailliere-Tindall, Publ.)* 28(3):728-734. Aug. 1980. SFA 25(4)

[Dep. Zool., Ohio State Univ., Columbus 43210] Experimental manipulation of breeding site quality did not alter the mate preference of female mottled sculpins (*Cottus bairdi*). Females of this species appear to choose mates on the basis of male size. By choosing a larger male, a female increases the probability that some of her eggs will hatch because large males are unlikely to abandon their nest sites.

80-002762 Dyagilev, S. Ye. and N. B. Markevich. DIFFERENT TIMES OF MATURATION OF THE PINK SALMON, *ONCORHYNCHUS GORBUSCHA*, IN EVEN AND UNEVEN YEARS AS THE MAIN FACTOR RESPONSIBLE FOR DIFFERENT ACCLIMATIZATION RESULTS IN THE NORTHWESTERN USSR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):30-44. 1979. SFA 25(4)

[VNIRO, Moscow, USSR] Data on the spawning times of the pink salmon, *Oncorhynchus gorbuscha*, in even and uneven years of reproduction in the northwestern USSR are examined. Pink salmon from the even year line constantly mature 2-3 weeks later than pink salmon from the uneven year line. At the temperature conditions observed in egg development this leads to constant mortality in the even line and to a relatively high rate of survival in the uneven line. Different spawning times produced different results in the acclimatization of the pink salmon in the lines of even and uneven years of reproduction.

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SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002763 Fursa, T. I. ON THE SEASONAL NATURE OF THE SPAWNING OF FISHES IN THE EASTERN PART OF THE ARABIAN SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):66-74. 1979. SFA 25(4)

[AzCherNIRO, Kerch, USSR] On the basis of the results of 942 ichthyoplankton samples, of an analysis of the stages of gonad maturity of 14,150 females and also of the correlation of published data, the seasonal nature of the reproduction of fish in the eastern part of the Arabian Sea, depending on monsoon periods, is examined.

80-002764 Grimes, C. B. and G. R. Huntsman. REPRODUCTIVE BIOLOGY OF THE VERMILION SNAPPER, *RHOMBOPLITES AURORUBENS*, FROM NORTH CAROLINA AND SOUTH CAROLINA. *NOAA Fish. Bull.* 78(1):137-146. 1980. SFA 25(4)

[Dep. Environ. Resour., Cook Coll. N. J. Agric. Exp. Stn., Rutgers Univ., New Brunswick, NJ 08903] The vermilion snapper, *Rhomboplites aurorubens*, a species often associated with Caribbean reefs and banks, is an important recreational fish of the outer continental shelf of North Carolina and South Carolina. Serial spawning occurs from late April through September off the Carolinas at depths ranging from 31 to 91 m. Most females spawn in the third or fourth year at about 205-275 mm total length. Larger, older females (age 5-10; up to 530 mm total length) appear to spawn longer each reproductive season, which may be an optimal strategy for maximizing reproductive biomass (balancing the physiological costs of somatic and gonadal growth). Overall sex ratio is unequal in favor of females (approximately 60%), but the ratio is 1:1 for small fish (less than 150 mm total length) and heavily in favor of large females (69-100% for fish greater than 500 mm total length) because they live longer than males. Fecundity of first spawners is estimated at 17-42 thousand eggs, and large females produce 1.5 million eggs.

80-002765 Gross, M. R. and W. A. Nowell. THE REPRODUCTIVE BIOLOGY OF ROCK BASS, *AMBLOPLITES RUPESTRIS* (CENTRARCHIDAE), IN LAKE OPINICON, ONTARIO. *Copeia* 1980(3):482-494. 6 Sept. 1980. SFA 25(4)

[Dep. Zool., Univ. Wash., Seattle 98195] The reproductive behavior of rock bass in Lake Opinicon begins with an abrupt movement of mature males to inshore nesting areas. Inshore density increases several fold and males become territorial, defending a bottom area in which they construct a nest by anal and pectoral fin displacement of the substrate. This results in a bowl shaped depression about 1.9 times male size. Nests are typically in coarse substrate and at 1/2 to 3/4 m water depth. Reproductive males (mean age 7.5 years) tolerate concurrently nesting pumpkinseed (*Lepomis gibbosus*) within half the distance separating neighboring rock bass. Males can complete a nest in one day but usually spawn after two days. Spawning activity occurs in late May depending upon water temperature. Females showed peak reproductive behaviors at 21-23 C. Gravid females approach and enter nests without male courtship and spawn about 500 eggs. During the spawning act the male's body color darkens. Circling behavior in the nest is irregular and the female is often exterior to the nest center. The eggs are emitted over a 2-hour period with the horizontal dipping motions common to centrarchids. One female may spawn with several males and one male may spawn with several females. However, despite this apprent promiscuity, it appears that females may choose males with which to spawn the majority of their eggs. Following spawning females leave the nest area and males provide parental care for eggs by fanning with the pectoral fins, and for larvae through predator defense. Males are highly aggressive and often charge towards a territory intruder with spread opercles or displaying an open mouth. About 33% of nests are unsuccessful, possibly due to brood predation. Eggs hatch after 5 days and fry leave the nest 9-10 days later. Twenty-four % of the males respawn, usually in new nests but in the same area. Females can also spawn again, as indicated by modal egg classes in the ovary. Most reproductive activity is confined within a three week period, but males raising a second brood remain with nests until late June or early July. Following nesting, the inshore density of rock bass returns to a prereproductive level.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002766 Gross, M. R. SEXUAL SELECTION AND THE EVOLUTION OF REPRODUCTIVE STRATEGIES IN SUNFISHES (*LEPOMIS*: CENTRARCHIDAE). *Ph.D. dissertation, Univ. Utah* 330p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(2):452. Aug. 1980. SFA 25(4)

80-002767 Lisovenko, L. A. and Z. S. Sil'yanova. THE FECUNDITY OF SOME SPECIES OF THE FAMILY NOTOTHENIIDAE IN THE ATLANTIC SECTOR OF THE SOUTHERN OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):79-85. 1979. SFA 25(4)

[VNIRO, Moscow, USSR] On the basis of the calculation of the individual fecundity of 267 specimens of fish belonging to 6 species of the genus *Notothenia* and one species of the genus *Trematomus*, a correlation-regression analysis of the dependence of fecundity on the length and weight of the female, investigation of the fecundity of fish of different ages and calculation of the index of population fecundity according to Ivlev, have been carried out by means of the Minsk-32 computer. It is shown that all these species may be divided into two groups, which differ as regards population fecundity.

80-002768 Lobel, P. S. and R. E. Johannes. NESTING, EGGS AND LARVAE OF TRIGGERFISHES (BALISTIDAE). *Environ. Biol. Fishes* 5(3):251-252. 29 Sept. 1980. SFA 25(4)

[Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138]

80-002769 Lund, R. VIVIPARITY AND INTRAUTERINE FEEDING IN A NEW HOLOCEPHALAN FISH FROM THE LOWER CARBONIFEROUS OF MONTANA. *Science* 209(4457):697-699. 8 Aug. 1980. SFA 25(4)

[Dep. Biol., Adelphi Univ., Garden City, NY 11530] A new species of Lower Carboniferous holocephalan chondrichthyan, *Delphyodontos dacriformes*, is described from two fetal specimens. The well-developed slashing and piercing dentition, enlargement of the abdominal region, and fecal material indicate the probable evolution of intrauterine oophagy and viviparity in Paleozoic Chondrichthyes.

80-002770 Moosleitner, H. ZENTRALE LAICHSTELLE ERMÖGLICHT *BLENNIUS PAVO*, RISSO 1810 (BLENNIIDAE, PERCIFORMES, TELEOSTEI) DIE BESIEDLUNG VON SANDGRUND. [A CENTRAL HATCHING HABITAT ENABLES *BLENNIUS PAVO*, RISSO 1810 (BLENNIIDAE, PERCIFORMES, TELEOSTEI) THE OCCUPATION OF SANDY BOTTOMS.] *Zool. Anz.* 204(1/2):82-88. 1980. In German with English summ. SFA 25(4)

[Zool. Inst., Univ. Salzburg, Austria]

80-002771 Morse, W. W. MATURITY, SPAWNING, AND FECUNDITY OF ATLANTIC CROAKER, *MICROPOGONIAS UNDULATUS*, OCCURRING NORTH OF CAPE HATTERAS, NORTH CAROLINA. *NOAA Fish. Bull.* 78(1):190-195. 1980. SFA 25(4)

[NMFS, Sandy Hook Lab., Highlands, NJ 07732]

80-002772 Morse, W. W. SPAWNING AND FECUNDITY OF ATLANTIC MACKEREL, *SCOMBER SCOMBRUS*, IN THE MIDDLE ATLANTIC BIGHT. *NOAA Fish. Bull.* 78(1):103-108. 1980. SFA 25(4)

[NMFS, Sandy Hook Lab., Highlands, NJ 07732] Collections of Atlantic mackerel, *Scomber scombrus*, were made during spring 1977 from Maryland to Rhode Island. Length-weight relationships were determined for total and fork lengths and total and gutted weights. Spawning time was determined from gonad somatic indices and peak spawning occurred between 21 April and 4 May. Egg diameter frequencies from running ripe ovaries indicated five to seven egg batches are spawned by each female during the spawning season. Fecundity was estimated and ranged from 285,000 to 1,980,000 for fish between 307 and 438 mm fork length. Fecundity was related to fork length, gutted weight, and age.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002773 Pagel, P. M.; R. MacGregor III and W. Siler. BEHAVIORAL STUDIES OF THE TELEOST *FUNDULUS GRANDIS*. *J. Ala. Acad. Sci.* 51(3):183. July 1980. Abstract only. SFA 25(4)
[Dep. Biol., Univ. Ala., Birmingham 35294] Qualitative observations were made on reproductive and agonistic behaviors of the estaurine Gulf Killifish, *Fundulus grandis*. Adult fish were maintained on a stimulatory photoperiod of LD 15:9 at approximately 22°C. Reproductive behavior patterns include herding, quivering, clasping and spawning. Unreceptive behavior by female includes fleeing, chasing and an "unreceptive stance." Agonistic behavior includes rapid approach, chase, lateral display, operculum spread, tailbeat, head-to-tail bout and occasional mouth lock. Submissive behavior includes fleeing and hiding. All agonistic behaviors have been seen in both sexes in male-male encounters and also in male-female encounters. There may be the potential for limited parental care although it has not been established and whether or not this occurs in the fish's natural habitat. Reproductive and agonistic coloration patterns were observed. Coloration and size of fish are both important factors involved with social interaction in *F. grandis*.

80-002774 Pietsch, T. W. and D. B. Grobecker. PARENTAL CARE AS AN ALTERNATIVE REPRODUCTIVE MODE IN AN ANTENNARIID ANGLERFISH. *Copeia* 1980(3):551-553. 6 Sept. 1980. SFA 25(4)
[Coll. Fish., Univ. Wash., Seattle 98195]

80-002775 Purych, P. R. SUCCESSFUL REPRODUCTION OF INTRODUCED LAKE TROUT IN HORNER LAKE, ONTARIO. *Prog. Fish-Cult.* 42(3):163-164. July 1980. SFA 25(4)
[Ontario Minist. Nat. Resour., Blind River Dist., Blind River, ON P0R 1B0, Canada]

80-002776 Rosa, E. and C. Williams. THE REPRODUCTIVE SYSTEM OF ONE SPECIES OF THE FAMILY CARCHARINIDAE. *J. Ala. Acad. Sci.* 51(3):184-185. July 1980. Abstract only. SFA 25(4)
[Dep. Biol., Carver Res. Lab., Tuskegee Inst., Tuskegee Institute, AL 36088]

80-002777 Sargent, R. C. and J. B. Gebler. EFFECTS OF NEST SITE CONCEALMENT ON HATCHING SUCCESS, REPRODUCTIVE SUCCESS, AND PATERNAL BEHAVIOR OF THE THREESPINE STICKLEBACK, *GASTEROSTEUS ACULEATUS*. *Behav. Ecol. Sociobiol.* 7:137-142. 1980. SFA 25(4)
[Dep. Ecol. Evol., State Univ., N.Y., Stoney Brook 11794]

80-002778 Shikhshabekov, M. M. THE REPRODUCTIVE BIOLOGY OF THE "KUTUM", *RUTILUS FRISII KUTUM*, THE ASP, *ASPIUS ASPIUS*, THE VIMBA, *VIMBA VIMBA PERSA*, AND THE RUDD, *SCARDINIUS ERYTHROPHTHALMUS*, IN THE WATERS OF DAGESTAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):98-105. 1979. SFA 25(4)
[Dagestan Agric. Inst., Makhachkala, USSR]

80-002779 Spivak, E. G.; G. N. Pinus and S. V. Sentishcheva. THE AGE COMPOSITION OF THE SPAWNING POPULATION AND THE CHARACTERISTICS OF THE SPAWNERS SIZE-AGE STRUCTURE AND FECUNDITY OF THE ROACH, *RUTILUS RUTILUS* SPAWNING IN KAKHOVKA RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):75-80. 1979. SFA 25(4)
[VNIRO, Moscow, USSR]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

80-002780 Sukhanova, G. I. THE SPAWNING AND FECUNDITY OF THE PIKE, *ESOX LUCIUS*, IN VILYUY RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):74-79. 1979. SFA 25(4)

[Dep. Ichthyol. Hydrobiol., Tomsk Univ., USSR] Information is given on the ecology of spawning of the pike, *Esox lucius*, from Vilyuy reservoir. Changes in fecundity are related to age and size of the fish, weight of gonads and egg diameter. It is shown that in Vilyuy reservoir the individual absolute fecundity of the pike is lower than in other bodies of water situated further south.

80-002781 Timmons, T. J.; W. L. Shelton and W. D. Davies. GONAD DEVELOPMENT, FECUNDITY, AND SPAWNING SEASON OF LARGEMOUTH BASS IN NEWLY IMPOUNDED WEST POINT RESERVOIR, ALABAMA-GEORGIA. *U.S. Fish Wildl. Serv. Tech. Pap.* 100. 6p. 1980. SFA 25(4)

[Ala. Coop. Fish. Res. Unit, Auburn Univ., Auburn 36830] The percentage of body weight contributed by the ovaries and frequency distributions of ovarian egg diameters were reliable indicators of the spawning season of largemouth bass, *Micropterus salmoides*, in West Point Reservoir in 1977. Spawning begam in mid-April and continued until mid-June. Some fish apparently spawned more than once, but no summer or fall spawning was indicated. Individual fecundity, determined by a dry weight method, ranged from 6,232 to 117,241 mature eggs for fish over 300 mm in total length. Fish shorter than 300 mm contributed few of the eggs produced. Eggs matured at a size larger than those described in other studies of largemouth bass. Regression equations were developed to describe the relation of fecundity to length, weight, and age; weight yielded the best correlation; Y=1,908.36 + 30.81 X. The fast-growing initial year classes (1975 and 1976) of largemouth bass dominated the reproducing population.

80-002782 Tricas, T. C. COURTSHIP AND MATING-RELATED BEHAVIORS IN MYLIOBATID RAYS. *Copeia* 1980(3):553-556. 6 Sept. 1980. SFA 25(4)

[Dep. Zool., Univ. Hawaii Manoa, Honolulu 96822]

80-002783 Veshchev, P. V. COMPOSITION OF THE SPAWNING POPULATION OF THE STURGEON, *ACIPENSER GÜLDENSTÄDTI* AND THE SEVRYUGA, *ACIPENSER STELLATUS*, IN THE SPAWNING GROUNDS OF AKHTUBA RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):151-155. 1979. SFA 25(4)

[TsNIORKh, Astrakhan, USSR] An analysis of the results of the size-weight and age composition of sturgeon spawners from Akhtuba river has shown that, compared with the Volga, the youngest and smallest fish move to spawn in the Akhtuba river spawning grounds. The mean age of sturgeon females and males was 20.9 and 16.1 years respectively, that of sevryuga females and males 16.8 and 13.5 years respectively. The mean absolute fecundity of sturgeon females in the Akhtuba river spawning grounds was 187.2 thousand eggs and that of the sevryuga 274.4 thousand eggs. The high mean absolute fecundity may be explained by the greater number of older females. Fish with gonads in stage V of maturity predominated among sturgeon spawners in Aktuba river, fish in completed stage IV of maturity among sevryuga spawners. Males predominated over females in the spawning population of the sturgeon, but in the sevryuga population females predominated over males. This may later lead to a curtailment of the sevryuga population. Under conditions of regulated discharge, the Akhtuba river should be preserved as a fisheries water body, of primary significance for the maintenance of sturgeon stocks.

80-002784 Wagner, W. C. and T. M. Stauffer. THREE-YEAR-OLD PINK SALMON IN LAKE SUPERIOR TRIBUTARIES. *Trans. Am. Fish. Soc.* 109(4):458-460. July 1980. SFA 25(4)

[Marquette Fish. Res. Stn., Mich. Dep. Nat. Resour., 484 Cherry Creek Rd., Marquette 49855]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

80-002785 Andriashev, A. P. [ON THE DEEPEST OCCURENCE OF A ZOARCID FISH (*LYCENCHELYS ATACAMENSIS* SP. N.) FROM THE ATACAMA TRENCH.] *Zool. Zh.* 59(7):1105-1108. July 1980. In Russian with English summ. SFA 25(4)
[Zool. Inst., USSR Acad. Sci., Leningrad, USSR]

80-002786 Duncan, T. O. and M. R. Myers, Jr. MOVEMENTS OF CHANNEL CATFISH AND FLATHEAD CATFISH IN BEAVER RESERVOIR, NORTHWEST ARKANSAS. *Proc. Ark. Acad. Sci.* 32:43-45. 1978. SFA 25(4)
[U.S. FWS, Multi-Outlet Reservoir Stud., Arkadelphia, AR 71923]

80-002787 Loeb, V. J. VERTICAL DISTRIBUTION AND DEVELOPMENT OF LARVAL FISHES IN THE NORTH PACIFIC CENTRAL GYRE DURING SUMMER. *NOAA Fish. Bull.* 77(4):777-793. 1980. SFA 25(4)
[Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92093]

80-002788 Love, M. S. ISOLATION OF OLIVE ROCKFISH, *SEBASTES SERRANOIDES*, POPULATIONS OFF SOUTHERN CALIFORNIA. *NOAA Fish. Bull.* 77(4):975-983. 1980. SFA 25(4)
[Dep. Biol., Occidental Coll., 1600 Campus Rd., Los Angeles, CA 90041] Movements of the olive rockfish, *Sebastes serranoides*, off Santa Barbara, California, were investigated, using mechanical and parasite tags. The movements were restricted over shallow reefs though somewhat less so around deeper oil platforms. Highly restricted movements may cause greater vulnerability of populations to overfishing--comparisons of olive rockfish size frequencies between two reefs indicated that fishing pressure had reduced olive rockfish populations to almost all prereproductive individuals on the more heavily fished site.

80-002789 Ruggles, C. P. A REVIEW OF THE DOWNSTREAM MIGRATION OF ATLANTIC SALMON. *Can. Tech. Rep. Fish Aquatic Sci.* No. 952. ix + 39p. July 1980. In English with French summ. SFA 25(4)
[Montreal Eng. Co., Ltd., 1526 Dresden Row, Halifax, NS, Canada]

FOODS/FEEDING

80-002790 Arnemo, R.; C. Puke and N. G. Steffner. FEEDING DURING THE FIRST WEEKS OF YOUNG SALMON IN A POND. *Arch. Hydrobiol.* 89(1-2):265-273. 1980. In English with Russian summ. SFA 25(4)
[Högskolan i Kalmar, Inst. Naturvet. Tek. Box 905, 391 29 Kalmar, Sweden] The first feeding of salmon, implanted in a pond, is shown to be zooplankton, especially *Heterocope saliens*. For the first 20 days each salmon consumes approximately 200 ind of this species, making up about half of the food. The total zooplankton consumption is calculated to be about 0.15 g fresh weight. The salmon grows from 26 to 37 mm. It is suggested that zooplankton sampling may be used as a method for predicting the growth of the fish.

80-002791 Beyer, J. E. FEEDING SUCCESS OF CLUPEOID FISH LARVAE AND STOCHASTIC THINKING. *Dana* 1:65-91. 1980. SFA 25(4)
[Danish Inst. Fish. Mar. Res., Charlottenlund Castle, DK-2920 Charlottenlund, Denmark] Feeding success is defined as the probability of capturing the prey organism assuming attack and is derived from basic principles as a function of the mouth size of the predator, the prey width

FOODS/FEEDING (CONTINUED)

80-002791 CONTINUED and the precision of the feeding strike. The model is evaluated with reference to data from the literature on larval anchovy (*Engraulis mordax*) and larval herring (*Clupea harengus*) feeding on *Artemia* nauplii. A theoretical attack-index of prey size preferences is obtained from the model under the assumption that larvae attempt to achieve maximum food consumption. Optimum prey width appears to be linearly related to larval mouth size.

80-002792 Bryazgunova, M. I. FEEDING RELATIONSHIPS OF THE YOUNG OF THE PIKE-PERCH, *LUCIOPERCA LUCIOPERCA*, THE BREAM, *ABRAMIS BRAMA*, AND FISHES OF LESSER IMPORTANCE IN THE LOWER REACHES OF THE DON. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):57-65. 1979. SFA 25(4)
[AzNIIRKh, Rostov-on-Don, USSR]

80-002793 Buchanan, D. V.; R. M. Hooton and J. R. Moring. NORTHERN SQUAWFISH (*PTYCHOCHEILUS OREGONENSIS*) PREDATION ON JUVENILE SALMONIDS IN THE WILLAMETTE RIVER BASIN. *Oreg. Dep. Fish. Wildl. Inf. Rep. Ser. Fish.* No. 80-2. 15p. Mar. 1980. SFA 25(4)
[Oreg. Dep. Fish. Wildl., Res. Dev. Sect., Corvallis]

80-002794 Cadwallader, P. L.; A. K. Eden and R. A. Hook. ROLE OF STREAMSIDE VEGETATION AS A FOOD SOURCE FOR *GALAXIAS OLIDUS GÜNTHER* (PISCES: GALAXIIDAE). *Aust. J. Mar. Freshwater Res.* 31(2):257-262. Apr. 1980. SFA 25(4)
[Fish. Wildl. Div., Minist. Conserv., Snobs Creek Freshwater Fish. Res. Stn. Hatchery, P.B. 20, Alexandra, Victoria 3714, Australia] Dipteran and trichopteran larvae, coleopteran adults and terrestrial invertebrates were the main items in the diet of *G. olidus* taken in summer from 10 stations in the Seven Creeks River system, Victoria. Ephemeropteran nymphs, coleopteran larvae and copepods also formed a large part of the diet. Terrestrial organisms were taken more frequently by larger fish than by smaller fish and formed a substantial part of the diet of those fish taken from sites surrounded by overhanging vegetation. Terrestrial organisms were much less common in the diet of fish taken from sites with little overhanging vegetation.

80-002795 Coates, D. AQUARIUM STUDIES ON THE ABILITY OF POTENTIAL PREDATORS TO LEARN TO AVOID HUMBUG DAMSELFISH, *DASCYLLUS ARUANUS* (PISCES, POMACENTRIDAE) AS PREY. *J. Comp. Ethol.* 52(3):285-290. 1980. SFA 25(4)
[Dep. Biol. Sci., Univ. Gezira, Sudan] Five species of potential predators of *D. aruanus* were trained in aquaria using a simple reward versus no-reward training technique in which *D. aruanus* (no-reward) and a variety of alternative prey species (reward) were presented simultaneously to the former. All the predators tested exhibited an ability to learn to approach the reward species of fish in preference to *D. aruanus*. Results are discussed in relation to the recently proposed theory that potential predators may learn in the field not to attack *D. aruanus* but to concentrate on alternative and more easily caught prey.

80-002796 Cordes, L. E. and L. M. Page. FEEDING CHRONOLOGY AND DIET COMPOSITION OF TWO DARTERS (PERCIDAE) IN THE IROQUOIS RIVER SYSTEM, ILLINOIS. *Am. Midl. Nat.* 104(1):202-206. July 1980. SFA 25(4)
[Ill. Nat. Hist. Surv., Urbana 61801] *Etheostoma microperca* and *E. zonale* are diurnal carnivores. Feeding activity in both species increased markedly (on 9-10 September 1977) after sunrise, peaked at midday, and decreased after sunset. *Etheostoma microperca* fed mainly on copepods (38-76% of all food items); in late afternoon the diet contained fewer copepods than usual and more chironomids. *Etheostoma zonale* fed most heavily on chironomids (59-96%) at all hours.

FOODS/FEEDING (CONTINUED)

80-002797 Crowder, L. B. ALEWIFE, RAINBOW SMELT AND NATIVE FISHES IN LAKE MICHIGAN: COMPETITION OR PREDATION? *Environ. Biol. Fishes* 5(3):225-233. 29 Sept. 1980. SFA 25(4)

[Dep. Zool., Univ. Wis., Madison 53706] Several native fish species in Lake Michigan became rare or locally extinct during the increase of rainbow smelt (1930s) and alewife (1950s-1960s). These particular native species have pelagic eggs or larvae which were large relative to the zooplankton and which co-occurred with feeding alewife, smelt or both. Alewife, smelt and most of the other planktivores in the lake probably consumed eggs, and at least alewife and smelt are known to consume larvae. For each species, I comment on the probable role of predation on early life history stages in their decline. Several species which currently co-exist with alewife and smelt have shown large scale declines during the increase of the exotics. Recruitment declines were often dramatic and the proabability of predation on these species during their early life history is evaluated.

80-002798 Cuff, W. R. BEHAVIORAL ASPECTS OF CANNIBALISM IN LARVAL WALLEYE, *STIZOSTEDION VITREUM*. *Can. J. Zool.* 58(8):1504-1507. Aug. 1980. In English with French summ. SFA 25(4)

[CSIRO, Div. Computing Res., P.O. Box 1800, Canberra, A.C.T., Australia 2601] Behavioral aspects of cannibalism in larval walleye (*Stizostedion v. vitreum*) are described. Conspecific prey were taken both head and tail first. Tail-first cannibalisms sometimes occurred wherein the cannibalized walleye was not ingested completely. This made it possible for a cannibal with partly-ingested prey to be cannibalized and "chains" of up to four fish were observed. As all larval walleye were roughly the same size, this observation suggests that larval walleye will take prey longer than themselves. This was also apparent from head-first encounters, with each fish trying to cannibalize the other.

80-002799 Gerking, S. D. and D. V. Plantz, Jr. SIZE-BIASED PREDATION BY THE GILA TOPMINNOW *POECILIOPSIS OCCIDENTALIS* (BAIRD AND GIRARD). *Hydrobiologia* 72(1-2):179-191. 10 July 1980. SFA 25(4)

[Dep. Zool., Ariz. State Univ., Tempe 85281] The objective of this study is to document under both field and laboratory conditions the phenomenon of size-biased feeding by the Gila topminnow, *Poeciliopsis occidentalis*, and to shed light on the mechanisms responsible for this process. Adult female Gila topminnows feed in Monkey Spring, Santa Cruz County, Arizona, on a variety of food items, but *Hyalella azteca* is an important element of its invertebrate diet. The size of the amphipods ingested by female topminnows is a function of the size of the fish, with larger fish taking larger prey. There is also a strong preference for topminnows to select large amphipods from within the size limits imposed by the width of the mouth. The correlation between fish size and prey size was also seen in the laboratory, utilizing *Daphnia similis* and food pellets as prey. The tendency to select large prey from a range of available sizes was prominent with both *Daphnia* and pellets. The feeding period in the laboratory is characterized by two distinct phases. During the first phase, feeding is rapid and nonselective. As the feeding progresses, the rate of feeding drops dramatically and selectivity increases. More complex laboratory feeding experiments gave equivocal results. When fish were presented pellets of two sizes at different densities and at different ratios of small to large, size biased feeding was not clearly evident. Both predator and prey densities, agonistic behavior, and reaction distance should be explored more thoroughly as next steps in attempts to mimic feeding behavior in nature.

80-002800 Gibson, R. M. OPTIMAL PREY-SIZE SELECTION BY THREE-SPINED STICKLEBACKS (*GASTEROSTEUS ACULEATUS*): A TEST OF THE APPARENT-SIZE HYPOTHESIS. *J. Comp. Ethol.* 52(3):291-307. 1980. SFA 25(4)

FOODS/FEEDING (CONTINUED)

80-002800 CONTINUED
[Arbeitsgruppe Verhaltensforsch., Abt. Biol., Ruhr Univ. Bochum, West Germany] The causal basis of optimal prey-size selection was investigated experimentally using Three-spined Sticklebacks (*Gasterosteus aculeatus*) as predators and two size classes of *Daphnia magna* as prey. When offered a choice between a large and a small daphnia sticklebacks took the apparently-larger prey, irrespective of its absolute size. However, the apparent size rule did not correctly predict the diet of fish feeding on mixed populations of the same two size classes, except at low prey densities. The observed pattern of predation was consistent with optimal diet theory.

80-002801 Goh, Y. and T. Tamura. OLFACTORY AND GUSTATORY RESPONSES TO AMINO ACIDS IN TWO MARINE TELEOSTS--RED SEA BREAM AND MULLET. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 66(2):217-224. 1980. SFA 25(4)
[Fish. Lab., Fac. Agric., Nagoya Univ., Nagoya, Japan] The olfactory and gustatory responses to amino acids were recorded electrophysiologically in two stocks of red sea bream (*Chrysophyrys major*) and mullet (*Mugil cephalus*). The olfactory spectra of amino acids determined from the bulbar response in the two stocks of red sea bream were more or less same, and the spectrum in mullet was also similar to that in the red sea bream. A comparison of the spectra revealed high similarity among intra- and inter-species. The gustatory spectra of amino acids were similar between the different two stocks of red sea bream, but the spectra were different from those obtained in other fishes. The gustatory spectrum of amino acids in mullet was different from that in other fishes. A comparison of the gustatory spectra revealed a species specificity. From the view of the species non-specificity of the olfactory spectrum of amino acids and the species specificity of the gustatory one, the functional difference between the olfactory and the gustatory response to amino acids in the feeding behaviour was discussed.

80-002802 Goh, Y. and T. Tamura. EFFECT OF AMINO ACIDS ON THE FEEDING BEHAVIOUR IN RED SEA BREAM. *Comp. Biochem. Physiol. C Comp. Pharmacol.* 66(2):225-229. 1980. SFA 25(4)
[Fish. Lab., Fac. Agric., Nagoya Univ., Nagoya, Japan] The effects of amino acids and betaine on the feeding behaviour of red sea bream (*Chrysophyrs major*) were studied by adding the chemicals to a casein-base purified diet. Among the 15 chemicals tested, 1/2 (alanine + Betaine), 1/2 glycine + betaine), L-alanine, L-valine, glycine, L-serine, L-arginine and L-glutamine were found to be effective in activating the feeding behavior. The behavioural experiments were concluded to harmonize well with the electrical activities of the gustatory system rather than those of the olfactory system.

80-002803 Goldschmid, A.; K. Kotrschal; W-D. Krautgartner and H. Adams. MORPHOLOGIE DES GEBISSES UND NAHRUNGSPRÄFERENZEN VON DREIZEHN ADRIATISCHEN BLENNIIDEN (TELEOSTEI, PERCIFORMES). [MORPHOLOGY OF THE TEETH AND FOOD PREFERENCES OF THIRTEEN SPECIES OF ADRIATIC BLENNIES (TELEOSTEI, PERCIFORMES).] *Zool. Scr.* 9(1):67-78. 1980. In German with English summ. SFA 25(4)
[Zool. Inst., Univ. Salzburg, Austria]

80-002804 Gorelova, T. A. THE FEEDING OF THE YOUNG OF SOME HOLOEPIPELAGIC FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):49-57. 1979. SFA 25(4)
[P. P. Shirshov Inst. Oceanol., USSR Acad Sci., (IOAN), Moscow, USSR] The feeding spectra of the young of *Nomeus albula*, *Naucrates ductor*, *Coryphaena hippurus*, and *C. equisetis* caught in the tropical part of the Pacific are examined. The main food items of *N. albula* and *N. ductor* are Cyclopoida and the copepodite stages of Calanoida. These species feed only during the day. The young of the dolphin feed mainly on hyponeuston

FOODS/FEEDING (CONTINUED)

80-002804 CONTINUED crustaceans of the family Pontellidae. Food capture takes place round the clock, but less intensively at night.

80-002805 Grabe, S. E. FOOD OF AGE 1 AND AGE 2 ATLANTIC TOMCOD, *MICROGADUS TOMCOD*, FROM HAVERSTRAW BAY, HUDSON RIVER, NEW YORK. *NOAA Fish. Bull.* 77(4):1003-1006. 1980. SFA 25(4)
[Normandeau Assoc., Inc., 15 Pickering Ave., Portsmouth, NH 03801]

80-002806 Hanson, J. M. and S. U. Qadri. MORPHOLOGY AND DIET OF YOUNG-OF-THE-YEAR BURBOT, *LOTA LOTA*, IN THE OTTAWA RIVER. *Can. Field-Nat.* 94(3):311-314. July-Sept. 1980. SFA 25(4)
[Dep. Biol., Univ. Ottawa, Ottawa, ON K1N 6N5, Canada] In August and September 1979, 41 young-of-the-year Burbot, *Lota lota*, were collected with a D.C. electrofisher in shallow water of the Ottawa River, near Ottawa, Ontario. The fish provide the second record of capture of young Burbot in eastern Canada outside of the Great Lakes. Head length was significantly longer and the first dorsal fin length, preanal length, postpectoral length, and predorsal length were shorter for juvenile Burbot compared to adults. The anal fin was white with a thin black edge and the pectoral fin rays were black. Young Burbot attained a mean total length of 87.3 mm and weighed 5.6 g in August and were an average of 102.9 mm long and weighed 7.6 g in September. The length-weight relationship was log WT=2.579 log TL - 4.299. Amphipods were the most important food item but 28.6% of the young Burbot ate darters (*Etheostoma* spp.) in September.

80-002807 Hofer, R. and R. Niederholzer. THE FEEDING OF ROACH (*RUTILUS RUTILUS* L.) AND RUDD (*SCARDINIUS ERYTHROPHTHALMUS* L.) II. FEEDING EXPERIMENTS IN THE LABORATORY. *Ekol. Pol.* 28(1):61-70. 1980. In English with Polish summ. SFA 25(4)
[Inst. Zool., Univ. Innsbruck, Peter-Mayr-Str. 1a, A-6020 Innsbruck, Austria] The daily relative consumption and the relative gut content at four temperatures and four diets applied in roach and rudd were studied. The daily relative consumption of filamentous algae and meal worms was below 8%, whereas maximum values up to 40% were obtained when food consisted of *Chara* or *Zannichellia*. These results were used for calculating the intestinal passage rate and the real activity of digestive enzymes in phytophagous fish. At a temperature range between 16 and 24°C the intestinal passage rate decreases with increasing consumption from about 9 hours to a minimum of 2-3 hours.

80-002808 Imabayashi, H. [FEEDING ACTIVITIES OF JUVENILE AND YOUNG BASTARD HALIBUT, *PARALICHTHYS OLIVACEUS*, IN THE BIOTIC COMMUNITY--I. INTRASPECIFIC RELATIONSHIPS IN THE POPULATION. *Bull. Jpn. Soc. Sci. Fish.* 46(4):427-435. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Dep. Fish., Fac. Agric., Kyushu Univ. 46-04, Hakozaki, Higashi-ku, Fukuoka 812, Japan] The intraspecific relationships within the juvenile and young bastard halibut have been studied in a growing area in the Genkai-Nada at approximately monthly intervals during 1976 and 1977, based on the stomach contents examined. At a depth of 5 m, many halibut under 120 mm in total length were found in May to October, feeding mainly on Mysidacea. At a depth of 5 m in 1976, change of the abundance of the halibut, change of the abundance of Mysidacea in the benthos fauna, and change of the amount of Mysidacea in the stomach of the halibut generally showed similar trends. In July to September, the amount of Mysidacea in the stomach decreased extremely accompanied by the following phenomena: (i) fall of the index of stomach fullness, (ii) difference of the stomach contents between small-sized fish and large-sized ones.

FOODS/FEEDING (CONTINUED)

80-002809 Kazanskiy, A. B. A MODEL OF THE TROPHIC NETWORK OF THE TSIMLYANSK RESERVOIR ICHTHYOCENOSIS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):86-91. 1979. SFA 25(4)

A mathematical, computer-produced model of the trophic network of the Tsimlyansk ichthyocenosis is submitted. A method of analyzing intrapopulation trophic relationships in a fish community by means of matrices of paired coupling coefficients is studied on the model and the method of modeling interrelationships between predators and prey is more accurately defined. The model is considered as a preparatory stage in the creation of a dynamic model of the Tsimlyansk reservoir ichthyocenosis.

80-002810 Keenan, C. L. and T. Miller. POPULATION RESPONSES OF *HYALELLA AZTECA* IN THE COLORADO RIVER TO PERIPHYTON STANDING CROP AND PREDATION BY THE RAZORBACK SUCKER (*XYRAUCHEN TEXANUS*). *Bull. Ecol. Soc. Am.* 61(2):52. June 1980. Abstract only. SFA 25(4)

[Univ. Nev., Las Vegas] Periphyton and benthic invertebrates were sampled at three discrete depths in the Colorado River 1.2 km below Hoover Dam. Numbers and biomass of *Hyalella azteca* were found to vary greatly at the three sampling areas. The largest numbers and biomass occurred on a shallow sand and cobble reef. Population size in mid-channel varied greatly with time due to the highly unstable nature of the substrate, which ranged from large to very small cobble and sand. The other area sampled in the channel consisted of large cobble and boulders. Numbers were high in this area, but the size of individuals was greatly reduced in these sites. Numbers of individuals at all three locations were correlated with periphyton standing crop. Observations of the razorback sucker revealed this fish to selectively inhabit the deeper portions of the river. The smaller size of amphipods in the deeper areas may be due not only to food availability, but also to selective predation by the razorback sucker.

80-002811 Kohler, C. C. and J. J. Ney. PISCIVORITY IN A LAND-LOCKED ALEWIFE (*ALOSA PSEUDOHARENGUS*) POPULATION. *Can. J. Fish. Aquatic Sci.* 37(8):1314-1317. Aug. 1980. In English with French summ. SFA 25(4)

[Fish. Res. Lab., South. Ill. Univ., Carbondale 62901]

80-002812 Kokes, J. THE FOOD EATEN BY THE FRY OF CHUB, *LEUCISCUS CEPHALUS*, IN THE ROKYTNÁ RIVER. *Folia Zool.* 28(4):361-370. 1979. SFA 25(4)

[Inst. Vert. Zool., Czech. Acad. Sci., Brno, Czechoslovakia] The food eaten by the chub fry in the Rokytná River consisted mainly of animal items. Of greatest importance were chironomid larvae which, during certain months, were supplemented or replaced by other items, above all, mayfly larvae and caddis worms. The chub fry subsisted mainly on aquatic organisms; terrestrial ones constituted only supplementary food; and the vegetable component was neglibible. The variation in trophic diversity showed a marked maximum in August and September, and a marked minimum in January. Chub fry of all size groups consumed almost identical diets. However, there were differences in the index of fulness which attained considerably higher values in the smallest fish examined in June than in bigger fish during the remaining months.

80-002813 Koslow, J. A. THE FEEDING OF SCHOOLS OF NORTHERN ANCHOVY (*ENGRAULIS MORDAX*), AND COMMUNITY STRUCTURE AND DIURNAL MIGRATORY BEHAVIOR IN MARINE ZOOPLANKTON. *Ph.D. dissertation, Univ. Calif. (San Diego)* 227p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(3):777. Sept. 1980. SFA 25(4)

80-002814 Maeda, T.; T. Takahashi and M. Ueno. [ECOLOGICAL STUDIES ON THE ALASKA POLLACK IN THE ADJACENT WATERS OF THE FUNKA BAY, HOKKAIDO--IV. SEASONAL VARIATIONS OF ZOOPLANKTON DISTRIBUTION IN FOOD FOR THE ALASKA

FOODS/FEEDING (CONTINUED)

80-002814 CONTINUED POLLACK.] *Bull. Jpn. Soc. Sci. Fish.* 46(6):671-674. June 1980. In Japanese with English summ. SFA 25(4)
[Fac. Fish., Hokkaido Univ., Minato-3, Hakodate 041, Japan]

80-002815 Mallatt, J. M. MECHANISM AND REGULATION OF FEEDING IN THE LARVAL LAMPREY *PETROMYZON MARINUS*. *Ph.D. dissertation, Univ. Chicago* 1980. From Diss. Abstr. Int. B Sci. Eng. 41(1):26. July 1980. SFA 25(4)

80-002816 Meyer-Rochow, V. B. STOMACH AND GUT CONTENTS OF *CARAPUS MOURLANI* FROM STARFISH AND A HOLOTHURIAN. *Ann. Zool. Fenn.* 16(4):287-289. 1980. SFA 25(4)
[Dep. Biol. Sci., Univ. Waikato, Hamilton, New Zealand] No echinoderm tissue was found in any of the eight fish recovered from coelomic cavities of cushion starfish, but the intestine of the fish contained well-digested traces of crustacean material. Of the seven fish collected from a holothurian host species, five had empty stomachs, but two contained semi-digested parts of a small brachyuran crab and a small carapid fish, whose position in the stomach indicated that it had entered tail first. The guts of all specimens contained fragments of crustacean material, bristles (probably of polychaete origin) and an amorphous orange substance. Although the results do not completely rule out parasitism for *C. mourlani*, it seems likely that both nocturnal foraging and the habit of residing inside echinoderms and other suitable hosts have evolved primarily as means for obtaining protection from diurnal predators and that any possible parasitic activity of the fish has evolved secondarily.

80-002817 Montgomery, W. L. COMPARATIVE FEEDING ECOLOGY OF TWO HERBIVOROUS DAMSELFISHES (POMACENTRIDAE: TELEOSTEI) FROM THE GULF OF CALIFORNIA, MEXICO. *J. Exp. Mar. Biol. Ecol.* 47(1):9-24. 14 Aug. 1980. SFA 25(4)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543] Two species of benthic damselfishes from the Gulf of California, Mexico, use contrasting behaviors when feeding on benthic algal communities. The small (± 70 g) Cortez damselfish, *Eupomacentrus rectifraenum* (Gill, 1862), feeds selectively from a multi-species algal mat, eats fleshy red and green algae and ignores brown and calcareous algae. The giant blue damselfish, *Microspathodon dorsalis* (Gill, 1862), is a large (± 450 g), lethargic, nonselective feeder which grazes on a near monoculture of a fleshy red alga, *Polysiphonia* sp. Feeding activity for both species is low in the morning, peaks during late afternoon, and drops sharply as night approaches. Based on feeding rates, gut-filling times, and weights of gut contents, Cortez damselfish process six to eight full guts of food and giant blue damselfish three full guts of food per day. The algal mat exhibits high standing crops (291-618 g dry wt/m^2) and low productivity, but the preferred food of the Cortez damselfish (*Ulva*) appears to colonize the mat frequently and grow rapidly. The *Polysiphonia* dominated community on giant blue damselfish territories exhibits low standing crops (23 g/m^2) and high productivity (34-47 times that of the mat per gram algae). Even though the feeding behaviors and resources used by the two damselfishes differ, both species eat similar foods (delicate red and green fleshy algae) and depend on rapid colonization and/or high productivity to maintain their primary foods in the grazed algal community.

80-002818 Niederholzer, R. and R. Hofer. THE FEEDING OF ROACH (*RUTILUS RUTILUS* L.) AND RUDD (*SCARDINIUS ERYTHROPHTHALMUS* L.). *Ekol. Pol.* 28(1):45-59. 1980. In English with Polish summ. SFA 25(4)
[Inst. Zool., Univ. Innsbruck, Peter-Mayr-Str. 1a, A-6020 Innsbruck, Austria] The influence of season and temperature on the feeding behaviour of roach and rudd in four Tyrolean lakes was studied. Both species are

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80-002818 CONTINUED characterized by a heterogeneous diet. In roach feeding is strongly affected by temperature, whereas in rudd no effect of season or temperature could be observed.

80-002819 Ormond, R. F. G. AGGRESSIVE MIMICRY AND OTHER INTERSPECIFIC FEEDING ASSOCIATIONS AMONG RED SEA CORAL REEF PREDATORS. *J. Zool. (Lond.)* 191(2):247-262. June 1980. SFA 25(4)

[Dep. Biol., Univ. York, York, England] A description is given of the range of interspecific feeding associations used by fish predators on a coral reef in the Sudanese Red Sea. The types of association observed are classified as (i) following and scavenging, (ii) hunting by "riding", (iii) hunting by aggressive mimicry and (iv) joint hunting. In particular quantitative accounts are given for previously undescribed examples of the use of riding by *Diploprion drachi* and *Chellinus diagrammus*, and of the use of aggressive mimicry by *Chellinus diagrammus* and *Ephibulus insidiator*. These two examples of aggressive mimicry involve colour change by the mimic which then associates with the species which it is mimicking. The frequency of the occurrence of joint hunting involving *Gomphosus caeruleus* and *Parupeneus chryseredros* or *P. macronema* is also described. In all, 24 species of predator were observed involved in one or more of these forms of feeding assocation. It is noted that some of these predators make use of these associations very frequently during feeding, and that they may associate with a selection of other species depending on their availability.

80-002820 Perrin, J. F. STRUCTURE ET FONCTIONNEMENT DES ECOSYSTEMS DU HAUT-RHONE FRANCAIS. 14-ETUDE DES PREFERENCES ALIMENTAIRES DE LA LOCHE FRANCHE (*NOEMACHEILUS BARBATULUS* L.) PAR UNE METHODE DES POINTS MODIFIEE. [STRUCTURE AND FUNCTION OF ECOSYSTEMS OF THE FRENCH UPPER RHONE. 14. STUDY OF FEEDING PREFERENCES OF THE STONE LOACH (*NOEMACHEILUS BARBATULUS* L.) WITH A MODIFIED POINT METHOD.] *Hydrobiologica* 71(3):217-224. 20 June 1980. In French with English summ. SFA 25(4)

[Dep. Biol. Anim. Zool., Univ. Lyon I, 69621 Villeurbanne, France] A method for analyzing the digestive contents of fishes, derived from Hynes' points method (1950) is described here and applied to the study of the diet of the stone loach populations, *Noemacheilus barbatulus*, from different biotopes of the Rhône river in France. Whatever the season or the location, the stone loach feeds mainly on larvae of Chironomids which are apparently captured by choice. Other insect larvae form a constant part of the ration but their abundance in the diet is under the dependence of an opportunistic feeding behaviour. Molluscs, Achaeta, Planaria and Oligochaeta, which are very common in the benthos, are never eaten. These preferences can be easily related to a particular trophic activity of the fish. They seem to be a specific and constant character of the biology of this very widely distributed species in all European running waters.

80-002821 Petersen, G. H. and M. A. Curtis. DIFFERENCES IN ENERGY FLOW THROUGH MAJOR COMPONENTS OF SUBARCTIC, TEMPERATE AND TROPICAL MARINE SHELF ECOSYSTEMS. *Dana* 1:53-64. 1980. SFA 25(4)

[Zool. Mus., Universitetsparken 15, 2100 Copenhagen Ø, Denmark] Biological production is estimated here for some major components of marine shelf ecosystems from subarctic, temperate and tropical areas (Disko Bugt, the North Sea, and Phangnga Bay, Thailand). Included are values for the production of phytoplankton and herbivorous zooplankton, the production of benthic deposit feeders and filter feeders at the compensation depth, and the yield to man of pelagic and demersal fish. Primary planktonic production increases from the subarctic to the topics, but the transfer of this energy to higher trophic levels appears most efficient in the high latitude ecosystem. Although the zooplankton comprises a dominant link within the tropical food web, energy flow in the subarctic may be more equally portioned between the benthos and the zooplankton. Consequently, pelagic organisms form

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80-002821 CONTINUED the basis for a fishery in the tropical study area while demersal forms are of greater importance in the subarctic. The existence of such fundamental differences in the structure of marine ecosystems implies that management models developed for temperate waters may sometimes require substantial modification to serve a useful purpose in subarctic or tropical waters.

80-002822 Reist, J. D. PREDATION UPON PELVIC PHENOTYPES OF BROOK STICKLEBACK, *CULAEA INCONSTANS*, BY SELECTED INVERTEBRATES. *Can. J. Zool.* 58(7):1253-1258. July 1980. In English with French summ. SFA 25(4)
[Dep. Ichthyol. Herpetol., Royal Ontario Mus., Toronto, ON M5S 2C6, Canada] Laboratory experiments investigated selective predation by aquatic insects upon phenotypes of brook stickleback (*Culaea inconstans*), *with* and *without* pelvises, from Wakomao Lake, Alberta, Canada. Predation by *Lethocerus americanus* (water bug) and nymphs of *Aeschna* spp. (dragonflies) was random upon each phenotype. Predation by the larvae of *Dytiscus* spp. (water beetle) resulted in significant selection for *with* individuals possessing five dorsal spines. The observed selection was at least partially due to closer approaches to the predator made by the *withs*. No selection occurred for either phenotype with six dorsal spines. This evidence supports an hypothesis that the pelvic variation is maintained by differential predation.

80-002823 Reist, J. D. SELECTIVE PREDATION UPON PELVIC PHENOTYPES OF BROOK STICKLEBACK, *CULAEA INCONSTANS*, BY NORTHERN PIKE, *ESOX LUCIUS*. *Can. J. Zool.* 58(7):1245-1252. July 1980. In English with French summ. SFA 25(4)
[Dep. Ichthyol. Herpetol., Royal Ontario Mus., Toronto, ON M5S 2C6, Canada] Laboratory and field work assessed the importance of *Esox lucius* predation in maintaining pelvic skeletal phenotypes in a population of *Culaea inconstans*. Individuals possessing a pelvis and pelvic spines (*with*) have a selective advantage over those lacking these parts (*without*). The latter are preferentially preyed upon in the lab by small northern pike due to this morphological difference. The advantage conferred by the spines depends upon relative size of predator to prey and likely has no effect upon predation by larger pike. Preferential selection of *with* individuals whose pelvic spines were removed, rather than *without* individuals (i.e. morphologically similar prey), suggests *withouts* compensate behaviourally for their morphological disadvantage. Analysis of food of large wild pike indicated that these postulated behavioural differences contributed to selective predation of individuals of the *with* phenotype in Wakomao Lake, Alberta, Canada. The frequency of these phenotypes in any situation represents a balance between counterselective forces, some of which are due to predation. Additional predatory species present in the lake and additional uses of pelvic spines probably also influence the phenotypic frequencies.

80-002824 Stiven, A. E. and R. T. Kneib. SOME RESPONSES OF THE SALT MARSH INFAUNAL AND EPIFAUNAL COMMUNITIES TO FISH PREDATION AND *SPARTINA* LITTER. *Bull. Ecol. Soc. Am.* 61(2):98. June 1980. Abstract only. SFA 25(4)
[Univ. N.C., Chapel Hill] Changes in the faunal communities of two different salt marshes were examined under differential regimes of killifish and blue crab predation and under varying levels of dead *Spartina* stem densities. Predation was manipulated by means of both enclosures and exclosures. The responses of several groups of the epifauna were conditioned by both time of year and by marsh. Predation produced the most notable effects in the polychaete taxa and the small gastropods with little effect on some of the arthropod groups. A reduction of the standing *Spartina* litter caused declines in larger polychaetes and ostracods. Size-specific predation by killifishes also produced significant responses in a variety of benthic infauna, especially small polychaetes and crustaceans. Interactions between vertebrate and invertebrate predators may condition some of the responses of the benthic faunal assemblages.

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80-002825 Taylor, W. W. and S. D. Gerking. POPULATION DYNAMICS OF *DAPHNIA PULEX* AND UTILIZATION BY THE RAINBOW TROUT (*SALMO GAIRDNERI*). *Hydrobiologia* 71(3):277-287. 20 June 1980. SFA 25(4)

[Dep. Fish. Wildl., Mich. State Univ., East Lansing 48824] The effect of rainbow trout (*Salmo gairdneri*) predation on the population dynamics of the water flea, *Daphnia pulex*, was examined during 1976 and 1977 in Becker Lake, a small, shallow, productive reservoir in northeastern Arizona. Rainbow trout were size-biased feeders, utilizing daphnids which were 1.3 mm in size or larger. Trout predation upon *Daphnia pulex* occurred mainly during winter and early spring when their numbers were relatively low but their clutch size high, suggesting that trout selected *Daphnia* on the basis of brood pigmentation. By far the greatest proportion of *Daphnia* mortality was due to nonpredatory sources, since generally less than 6% could be attributed to trout predation. The *D. pulex* population exhibited a bimodal seasonal abundance curve which was attributed to ephippial egg production and trout predation during the winter and poor food quality/quantity during the summer.

80-002826 Walters, L. L. and E. F. Legner. IMPACT OF THE DESERT PUPFISH, *CYPRINODON MACULARIUS*, AND *GAMBUSIA AFFINIS AFFINIS* ON FAUNA IN POND ECOSYSTEMS. *Hilgardia* 48(3):1-18. Feb. 1980. SFA 25(4)

[Dep. Entomol., Univ. Calif., Davis] Effects of populations of *Cyprinodon macularius* Baird and Girard (desert pupfish) and *Gambusia affinis affinis* (Baird and Girard) on aquatic insects and zooplankton were investigated in shallow ponds clear of emergent vegetation and those planted with rice. Presence of both fish caused equivalently lower densities of beneficial insect predators, mosquitoes, and zooplankton. Except for some behavioral feeding differences, food consumption appeared to be related to the density of food organism available. *Cyprinodon macularius* foraged primarily in the benthos, where it consumed chironomid midge larvae, aquatic vegetation, snails, detritus, and some zooplankton and insect predator groups; whereas, *G. affinis*, foraging more at the surface, consumed a diverse selection of terrestrial insects as well as chironomid midge larvae, more planktonic zooplankters, snails, and some insect predators. *Cyprinodon macularius* appears to be an acceptable substitue for *G. affinis* in mosquito control, and may be preferred in habitats harboring other native fishes due to minimal piscivorous behavior.

80-002827 Werner, R. G. and J. H. S. Blaxter. GROWTH AND SURVIVAL OF LARVAL HERRING (*CLUPEA HARENGUS*) IN RELATION TO PREY DENSITY. *Can. J. Fish. Aquatic Sci.* 37(7):1063-1069. July 1980. SFA 25(4)

[Dep. Environ. For. Biol., SUNY Coll. Environ. Sci. For., Syracuse 13210]

80-002828 Yermolin, V. P. THE INFLUENCE OF PREDATORS ON THE FISH POPULATION IN SARATOV RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):81-85. 1979. SFA 25(4)

[Saratov Dep., State Res., Inst. Lake River Fish., USSR] In Saratov reservoir predators consumed fish up to 30 cm long. Predator effect was greatest on prey less than 10-15 cm long. With the increase in the size of prey the degree of predation decreased. The young of the silver carp, bighead and black carp should be 20.0-22.5 cm long and weigh 200-220 g when released into Saratov reservoir.--Concl.

80-002829 Yoshiyama, R. M. FOOD HABITS OF THREE SPECIES OF ROCKY INTERTIDAL SCULPINS (COTTIDAE) IN CENTRAL CALIFORNIA. *Copeia* 1980(3):515-525. 6 Sept. 1980. SFA 25(4)

[Environ. Sci. Div., Oak Ridge Natl. Lab., P.O. Box X, Oak Ridge, TN 37830] Food habits of three intertidal sculpins--*Oligocottus snyderi*, *Cinocottus analis* and *Artedius lateralis*--were determined from examination of

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80-002829 CONTINUED stomach contents. *C. analis* had the most diverse diet. *O. snyderi* and *A. lateralis* had roughly similar levels of diversity in their diets, although they concentrated on different food items (*O. snyderi* on amphipods and polychaetes, and *A. lateralis* on shrimp and fishes). There were no statistical differences in diet composition between large and small fish within species. Size classes of *C. analis* had the greatest average diversity of food while size classes of *A. lateralis* had the lowest average diversity. *O. snyderi*, the smallest species, generally took the smallest prey while *A. lateralis*, the species with the largest gape, took the largest prey. Variation in prey size was smallest for *O. snyderi* and largest for *A. lateralis*. Much of the variation in prey sizes eaten by each species was due to the large average variation in prey sizes eaten by individual size classes. Information on food habits is combined with earlier data on intertidal distributions of the fishes. Differences among species in the use of food and space resources are viewed as a way for species to minimize, and as a possible result of, compeition. Some degree of complementarity in use of resource dimensions (tidepool category, food category, prey size) also indicates that competition may have influenced patterns of resource use shown by these fishes.

AGE AND GROWTH

80-002830 Baglin, R. E., Jr. LENGTH-WEIGHT RELATIONSHIPS OF WESTERN ATLANTIC BLUEFIN TUNA, *THUNNUS THYNNUS*. *NOAA Fish. Bull.* 77(4):995-1000. 1980. SFA 25(4)
[NMFS, P.O. Box 686, Kodiak, AK 99615]

80-002831 Borets, L. A. THE POPULATION STRUCTURE OF THE BOARFISH, *PENTACEROS RICHARDSONI*, FROM THE EMPEROR SEAMOUNTS AND THE HAWAIIAN RIDGE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):15-20. 1979. SFA 25(4)
[TINRO, Vladivostok, USSR]

80-002832 Bruton, M. N. and B. R. Allanson. GROWTH OF *CLARIAS GARIEPINUS* IN LAKE SIBAYA, SOUTH AFRICA. *S. Afr. J. Zool.* 15(1):7-15. 1980. In English with Afrikaans summ. SFA 25(4)
[Inst. Freshwater Stud., Rhodes Univ., Grahamstown, South Africa] Pectoral spines from 750 *Clarias gariepinus* (Pisces: Clariidae) from Lake Sibaya were used for age and growth determinations. The spines have clear rings in the bone matrix. Rings formed on otoliths, vertebrae and opercula were less useful. A close correlation between ages determined from length frequency data and ages obtained by back-calculation of lengths for different ring classes exists. Spine rings are laid down annually, except in the first year. *C. gariepinus* in Lake Sibaya grow rapidly and remain in good condition to a length of about 500 mm (age 3+ years) but of the larger catfish, few exceed 650 mm (7+ years). Males growth slightly faster than females, and modal sizes are 580-590 mm TL, and 540-550 mm TL. Over one third of the adult population measures between 500 and 600 mm TL due to the sharp deceleration of growth rate after 500 mm TL. Modal length and growth rate of Sibaya catfish is equal to that of other *C. gariepinus* populations, but the number and condition of larger individuals is lower, probably because of inadequate food resources in deep water.

80-002833 Crivelli, A. THE EYE LENS WEIGHT AND AGE IN THE COMMON CARP, *CYPRINUS CARPIO* L. *J. Fish Biol.* 16(5):469-473. May 1980. SFA 25(4)
[Stn. Biol. Tour Valat, Le Sambuc, F-13200 Arles, France] The validity of

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80-002833 CONTINUED the use of the weight of dried eye lenses as an indicator of age in the common carp, *Cyprinus carpio* L., is tested. There is a significant difference between males and females for fish of two and three years old. Otherwise no significant difference is noted between sexes. The linear relationship between the dry weight of eye lenses and age +1 are: ln Y + 1 = 0.5202 + 16.4928X (r=0.93) for female and ln Y + 1 = 0.4276 + 16.7364X (r=0.94) for male. The method for determining age is valuable for fish until three years old. However for older fish, in spite of a correlation coefficient between lens weight and age and even with a significant difference between annual groups, the age determination may be misleading due to the overlap in lens weights. In conclusion therefore this method may not be useful for back calculation of growth, for production estimates or studies in which accurate estimates of age are needed.

80-002834 Duncan, T. O. and M. R. Myers, Jr. LONGEVITY OF WHITE BASS IN BEAVER RESERVOIR, ARKANSAS. *Proc. Ark. Acad. Sci.* 32:87-88. 1978. SFA 25(4)
[U.S. FWS, Arkadelphia, AR 71923]

80-002835 Fagade, S. O. THE MORPHOLOGY OF THE OTOLITHS OF THE BAGRID CATFISH, *CHRYSICHTHYS NIGRODIGITATUS* (LACEPEDE) AND THEIR USE IN AGE DETERMINATION. *Hydrobiologia* 71(3):209-215. 20 June 1980. SFA 25(4)
[Dep. Zool., Univ. Ibadan, Nigeria] Two pairs of otoliths, the saccular and sagittae are shown to be well developed in the catfish, *Chrysichthys nigrodigitatus*. The gross morphology of each pair is provided. Growth markings arranged in a periodic manner are demonstrated. In addition, daily growth marks are shown to be present. The growth markings on the sagittae are interpreted and used in estimating the age and growth of the species.

80-002836 Heisey, P. G.; D. Mathur and N. C. Magnusson. ACCELERATED GROWTH OF SMALLMOUTH BASS IN A PUMPED STORAGE SYSTEM. *Trans. Am. Fish. Soc.* 109(4):371-377. July 1980. SFA 25(4)
[Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518]

80-002837 Kilambi, R. V. and W. R. Robison. AGE AND GROWTH OF CARP FROM BEAVER RESERVOIR, ARKANSAS. *Proc. Ark. Acad. Sci.* 32:91-92. 1978. SFA 25(4)
[Dep. Zool., Univ. Ark., Fayetteville 72701]

80-002838 Kimura, D. K. LIKELIHOOD METHODS FOR THE VON BERTALANFFY GROWTH CURVE. *NOAA Fish. Bull.* 77(4):765-776. 1980. SFA 25(4)
[Wash. Dep. Fish., Olympia 98504] Liklihood methods for the von Bertalanffy growth curve are examined under the assumption of independent, normally distributed errors. The following are examined: determining the best method of estimation, relationships between methods of estimation, failure of assumptions, constructing confidence regions, and applying likelihood ratio tests. An example is presented illustrating many of the methods discussed in theory. The paper may be viewed as an application of classic nonlinear least squares methods to the von Bertalanffy curve. As such, the concepts discussed are generally applicable and the paper may serve as an introduction to nonlinear least squares.

80-002839 Radtke, R. L. and K. G. Waiwood. OTOLITH FORMATION AND BODY SHRINKAGE DUE TO FIXATION IN LARVAL COD (*GADUS MORHUA*). *Can. Tech. Rep. Fish. Aquatic Sci.* No. 929. iii + 10p. June 1980. In English with French summ. SFA 25(4)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada] Daily increments were found to develop in the otoliths of larval cod with the first

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80-002839 CONTINUED increment formed the day after hatching. Scanning electron microscope data pointed to the formation of a "metamorphic" check that occurred at the time of yolk-sac absorption. With this information it might be possible to accurately age and determine the growth of this important commercial fish species. Fixation of reared cod larvae in ethanol resulted in body shrinkage which was dependent upon the age of the larvae and independent of the time of death. These data give a strong alternative to formalin fixation.

80-002840 Stanley, C. A. LEE'S PHENOMENON IN THE WESTERN SUBSPECIES OF THE AUSTRALIAN SALMON, *ARRIPIS TRUTTA ESPER*. *Aust. J. Mar. Freshwater Res.* 31(1):13-19. Mar. 1980. SFA 25(4)

[Div. Fish. Oceanogr., CSIRO, P.O. Box 21, Cronulla, N.S.W. 2230, Australia] Lee's phenomenon is apparent in scale readings of the western subspecies of *A. trutta esper*. A hypothesis involving a progressive eastward decrease in growth rate of fish from juvenile areas coupled with the progressive entry of these fish into the adult fishing area is advanced to explain the appearance of the phenomenon. The phenomenon can be included under the effects of biased sampling, although not in the normally accepted sense. Here it is apparently caused in the adult fishery by the selective arrival of fish with progressively slower growth rates, and in juvenile areas by the selective departure of faster-growing fish. If the hypothesis is correct this type of situation may occur in other species exhibiting a cline in growth rate that migrate from nursery areas to a separate spawning or adult area.

80-002841 Steffensen, E. DAILY GROWTH INCREMENTS OBSERVED IN OTOLITHS FROM JUVENILE EAST BALTIC COD. *Dana* 1:29-37. 1980. SFA 25(4)

[Danish Inst. Fish. Mar. Res., Charlottenlund Castle, DK-2920 Charlottenlund, Denmark] Difficulties in age determination of adult cod from the Baltic east of Bornholm by means of their otoliths were the reason for beginning this study. As especially there is some doubt regarding the growth within the first year of life the work is entirely concerned with young cod. Thin sections of otoliths from juvenile cod showed a number of uniform growth zones each of which seems to correspond to daily growth. The number of growth zones were counted in order to establish the approximate birthdate for each cod. These dates were in some cases different from the known spawning period by possibly a few weeks suggesting that an unknown number of growth zones in the central part of the otolith have escaped detection and that the methods ought to be improved.

80-002842 Sugiwaka, K. and H. Kojima. [STUDIES ON THE SMOLT OF JUVENILE MASU SALMON (ONCORHYNCHUS MASOU) IN THE ATSUTA RIVER. AGE AND ECOLOGY OF SMOLTS IN 1978.] *Sci. Rep. Hokkaido Fish Hatchery* No. 34. p. 25-39. Dec. 1979. In Japanese with English summ. SFA 25(4)

[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan] The ecological investigations on the sea-run form (smolt) of juvenile Masu salmon were carried out in the Atsuta River in mid-April and mid-May of 1978, and remarkable findings on the age of smolt were procured. The method of age determination in this study was as follows; in number of ridges from central plate on sclaes, the most outside ridge of annulus ranging between 5 and 9 was regarded as the simulate annulus, while ranges from 10 to 18 and 20 to 27 were regarded as the actual first and second annulus, respectively. According to the literatures, it has been described that the greater part of smolt of juvenile Masu salmon observed in the rivers and the coast of the North Japan were 1-year-old (2_2) but 2-year-old (3_3) smolt occupied only 2 or 3 per cent in the frequency. But in the Atsuta River, the frequency of 2-year-old smolt was markedly high (41.3 per cent). The numerical difference of the frequency of 2-year-old smolt in this study and in the other reports can not be explained clearly at present. Some reasons for this difference, however, were considered: 1) selectivity to fish of sampling method (angling), 2) difference of the age determination method, 3)

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80-002842 CONTINUED difference of locality. Several 1-year-old small parr which commenced neither phase differentiation nor smolt transformation were found, and it is considered that these small parr will differentiate into 2-year-old smolt or stream resident parr by next spring. The 2-year-old smolt examined exhibited characteristics suggesting a high degree of inferior growth during the period of one year after hatching. Hence, if the emergence of 2-year-old smolt depends on inferiority of growth, it is supposed that its frequency may fluctuate yearly, because it must be influenced by the environment of the river, especially, the amount of feed, the number of anadromous adults, and the individual density of parr in the river.

80-002843 Swanson, R. D. AGING LONGNOSE SUCKERS (*CATOSTOMUS CATOSTOMUS*) A COMPARISON OF METHODS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:96-97. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901] Abstract only. SFA 25(4)

[Dep. Biol., Univ. Wyo., Laramie] Age and back-calculated growth rates were determined using scales, pectoral fin-ray sections, and opercles taken from 326 longnose suckers. Fin-ray sections proved to be the most accurate in assessing age and growth rates. Results from opercles generally agreed with those from fin rays, although the opercle results consistently underestimated the age by one year. Ages as assessed using fin rays and opercles indicated extremely slow growth and long-lived fish (24 years). Ages assessed by scales indicated moderate growth rates and a maximum life of eight years. Data from tagged fish and observed growth rates of 0+ fish indicate that the fin-ray section method was the most accurate method examined.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-002844 Bath, H. *OMOBRANCHUS PUNCTATUS* (VALENCIENNES 1836) NEU IM SUEZ-KANAL. [*OMOBRANCHUS PUNCTATUS* (VALENCIENNES 1836) NEW IN THE SUEZ CANAL.] *Senckenbergiana Biol.* 60(5/6):317-319. 1979. In German with English summ. SFA 25(4)

[Luisenstr. 45, D-6780 Pirmasens, West Germany]

80-002845 Blaber, S. J. M. FISH OF THE TRINITY INLET SYSTEM OF NORTH QUEENSLAND WITH NOTES ON THE ECOLOGY OF FISH FAUNAS OF TROPICAL INDO-PACIFIC ESTUARIES. *Aust. J. Mar. Freshwater Res.* 31(2):137-146. Apr. 1980. SFA 25(4)

[Dep. Zool., Univ. Natal, P.O. Box 375, Pietermaritzburg, Natal 3200, South Africa] The fish faunas of tropical Trinity estuary and adjacent Trinity Bay are described. The fauna of the estuary is compared with that of other tropical Indo-Pacific estuaries and is found to be similar: all are dominated by juvenile marine fish. Numbers of planktivores are high and swimming prawns are an important food for many species. Absence of extensive shallow areas and a low biomass of benthic animals in Trinity estuary apparently limits the number of benthic feeding fish. Piscivores are few in the estuary and mainly represented by juvniles. Trinity Bay has fewer species represented by juveniles than the estuaries, higher numbers of piscivores, mainly adults, and fewer planktivores. The species diversity of Mugilidae in all areas is probably influenced by substrate diversity. Physical data indicate that substrate, turbidity and depth, together with relatively calm water in estuaries, affect the distribution of juvenile marine fish. If Trinity Bay is representative of areas of open water adjacent to tropical estuaries, the significantly lower numbers of piscivores in the estuaries may increase their advantage as sanctuaries for juvenile fish.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002846 Burr, B. M. A DISTRIBUTIONAL CHECKLIST OF THE FISHES OF KENTUCKY. *Brimleyana* No. 3. p. 53-84. July 1980. SFA 25(4)
[Dep. Zool., South. Ill. Univ., Carbondale 62901] A compilation of records of fishes from Kentucky waters based on specimens depositied in museums, personal collecting, and accepted literature reports revealed that 229 species occur or did occur in the state. A substantial amount of new distributional data is presented in the form of an annotated list including records of several species of fishes previously unreported from the state. Distributional statements in the checklist are based on individual spot maps completed for all Kentucky fishes. A list of five problematical species is included at the end of the checklist.

80-002847 Burr, B. M. and R. L. Mayden. DISPERSAL OF RIANBOW SMELT, *OSMERUS MORDAX*, INTO THE UPPER MISSISSIPPI RIVER (PISCES: OSMERIDAE). *Am. Midl. Nat.* 104(1):198-201. July 1980. SFA 25(4)
[Dep. Zool., South. Ill. Univ., Carbondale 62901] Three recent winter collections of *Osmerus mordax* from the Mississippi River, Illinois, document for the first time the presumed natural occurrence of the species outside the Great Lakes watershed. *Osmerus mordax* probably used the Chicago Canal-Illinois River connection to disperse into the Mississippi River. Examination of meristic characters indicated that the Mississippi River records are referable to the nominal *O. m. mordax*, the form originally introduced into the Great Lakes.

80-002848 Bussing, W. A. and M. I. López S. *GUENTHERUS ALTIVELA* OSORIO, THE FIRST ATELEOPODID FISH REPORTED FROM THE EASTERN PACIFIC OCEAN. *Rev. Biol. Trop.* 25(2):179-190. Dec. 1977. SFA 25(4)
[Esc. Biol., Univ. Costa Rica, Costa Rica]

80-002849 Dewey, M. R. and T. E. Moen. FISHES OF THE CADDO RIVER, ARKANSAS AFTER IMPOUNDMENT OF DEGRAY LAKE. *Proc. Ark. Acad. Sci.* 32:39-42. 1978. SFA 25(4)
[U.S. FWS, Multi-Outlet Reservoir Stud., Arkadelphia, AR 71923]

80-002850 Gilligan, M. R. THE ISLAND AND MAINLAND BIOGEOGRAPHY OF RESIDENT ROCKY-SHORE FISHES IN THE GULF OF CALIFORNIA. *Ph.D. dissertation, Univ. Ariz.* 150p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(2):452. Aug. 1980. SFA 25(4)

80-002851 Golovan', G. A. and N. P. Pahkorukov. A CATCH OF *ACANTHONUS ARMATUS* (FAMILY BROTULIDAE) OFF THE COAST OF NORTH-WEST AFRICA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):142-143. 1979. SFA 25(4)
[SEKBP, Sevastopol, USSR]

80-002852 Harris, J. L. and N. L. Douglas. FISHES OF THE MOUNTAIN PROVINCE SECTION OF THE OUACHITA RIVER. *Proc. Ark. Acad. Sci.* 32:55-59. 1978. SFA 25(4)
[Dep. Zool., Univ. Tenn., Knoxville 37916]

80-002853 Ivankov, V. N. and A. Ye. Samylov. FISH SPECIES NEW TO THE WATERS OF THE USSR AND THE PENETRATION OF WARMWATER FISHES INTO THE NORTHWESTERN SEA OF JAPAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):147-148. 1979. SFA 25(4)
[Dep. Ichthyol. Hydrobiol., Far East. Univ., Vladivostok, USSR]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002854 Knox, R. F. COLORADO'S NONGAME FISHES. TIME FOR REVIEW. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:95-96. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)
[Colo. Div. Wildl., Denver 80216] Recent fisheries surveys funded by the Colorado Division of Wildlife's Nongame Program have clarified the status of several species of threatened or endangered fishes. Information on Colorado River fishes, Cutthroat Trout, and Eastern Plains fishes will be briefly reviewed. The status of the nongame funding base, the income tax check-off fund, and the aquatic portion of the Nongame Program (approximately 25% of the total) will also be discussed. The possibilities for future recovery efforts and priorities in nongame aquatics, including the species listing procedures will be opened for discussion.

80-002855 Kojima, H. and T. Hikita. [FIRST OCCURRENCE OF ABURAHAYA, *PHOXINUS LAGOWSKI* F. *STEINDACHNERI*, IN HOKKAIDO.] *Sci. Rep. Hokkaido Fish Hatchery* No. 34. p. 57-61. Dec. 1979. In Japanese with English summ. SFA 25(4)
[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan]

80-002856 Kristensen, J. LARGE FLATHEAD CHUB (*PLATYGOBIO GRACILIS*) FROM THE PEACE-ATHABASCA DELTA, ALBERTA, INCLUDING A CANADIAN RECORD. *Can. Field-Nat.* 94(3):342. July-Sept. 1980. SFA 25(4)
[LGL Ltd., Environ. Res. Assoc., 10110-124 St., Edmonton, AB T5N 1P6, Canada]

80-002857 Maret, T. R. and E. J. Peters. THE FISHES OF SALT CREEK BASIN, NEBRASKA. *Trans. Nebr. Acad. Sci.* 8:35-54. 1980. SFA 25(4)
[Dep. Environ. Control, Lincoln 68508]

80-002858 Margulies, D.; O. S. Burch and B. F. Clark. REDISCOVERY OF THE GILT DARTER (*PERCINA EVIDES*) IN THE WHITE RIVER, INDIANA. *Am. Midl. Nat.* 104(1):207-208. July 1980. SFA 25(4)
[Dep. Mar.-Estuar.-Environ. Sci., Univ. Md., College Park 20742]

80-002859 Matarese, A. C. and D. L. Stein. ADDITIONAL RECORDS OF SCULPIN *PSYCHROLUTES PHRICTUS* IN THE EASTERN BERING SEA AND OFF OREGON. *NOAA Fish. Bull.* 78(1):169-171. 1980. SFA 25(4)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-002860 Matthews, W. J. ADDITIONS TO THE FISH FAUNA OF PINEY CREEK, IZARD COUNTY, ARKANSAS. *Proc. Ark. Acad. Sci.* 32:92. 1978. SFA 25(4)
[Dep. Biol., Roanoke Coll., Salem, VA 24153]

80-002861 Robison, H. W. DISTRIBUTION AND HABITAT OF THE TAILLIGHT SHINER, *NOTROPIS MACULATUS* (HAY), IN ARKANSAS. *Proc. Ark. Acad. Sci.* 32:68-70. 1978.
[Dep. Biol. Sci., South. Ark. Univ., Magnolia 71753]

80-002862 Robison, H. W. and S. A. Winters. THE FISHES OF MORO CREEK, A LOWER OUACHITA RIVER TRIBUTARY, IN SOUTHERN ARKANSAS. *Proc. Ark. Acad. Sci.* 32:71-75. 1978. SFA 25(4)
[Dep. Biol. Sci., South. Ark. Univ., Magnolia 71753]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

80-002863 Rosen, D. E. FISHES FROM THE UPLANDS AND INTERMONTANE BASINS OF GUATEMALA: REVISIONARY STUDIES AND COMPARATIVE GEOGRAPHY. *Bull. Am. Mus. Nat. Hist.* 162(5):269-375. 1979. SFA 25(4)
[Dep. Ichthyol., Am. Mus. Nat. Hist., New York, NY]

80-002864 Shtundyuk, Yu. V. THE LAKE MINNOW, *PHOXINUS PERCNURUS*, - A NEW SPECIES IN THE ICHTHYOFAUNA OF THE ANADYR ZOOGEOGRAPHIC REGION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):151-154. 1979. SFA 25(4)
[Far East. Res. Cent., USSR Acad. Sci., Magadan, USSR]

80-002865 Tesch, F.-W. OCCURRENCE OF EEL *ANGUILLA ANGUILLA* LARVAE WEST OF THE EUROPEAN CONTINENTAL SHELF, 1971-1977. *Environ. Biol. Fishes* 5(3):185-190. 29 Sept. 1980. SFA 25(4)
[Biol. Anst. Helgo. (Zentr.), Palmaille 9, Hamburg 50, West Germany]

80-002866 Walker, S. R. DISTRIBUTION OF FISHES IN THIRTY-TWO MILE CREEK, NEBRASKA. *Trans. Nebr. Acad. Sci.* 8:91-98. 1980. SFA 25(4)
[Dep. For. Fish. Wildl., Univ. Nebr., Lincoln 68583]

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

80-002867 Avery, E. L. FACTORS INFLUENCING REPRODUCITON OF BROWN TROUT ABOVE AND BELOW A FLOOD WATER DETENTION DAM ON TROUT CREEK, WISCONSIN. *Wis. Dep. Nat. Resour. Res. Rep.* 106. 26p. 1980. SFA 25(4)
[1206 Royalton, Waupaca, WI 54981] This study was initiated to determine the influence of a flood water detention dam upon the spawning environment and survival of brown trout eggs in Trout Creek, Wisconsin. Trout redds were counted above and below the detention dam during the fall of 1975, 1976, and 1977. Substrate compositon, intragravel temperatures, and intragravel dissolved oxygen (D.O.) were monitored in selected redds above and below the dam. Embryo development and survival were determined in each stream reach by excavating trout redds throughout the respective egg incubation periods. Stream temperature and discharge in each stream reach were also monitored. Brown trout spawning generally occurred from late October to mid-December and began 1 to 2 weeks earlier below the detention dam than above it. Each year, more than twice as many redds were constructed above the dam than below it. A higher incidence of superimposition and "false" redds occurred below the dam and was attributed to a lack of suitable spawning areas. The composition of redd material above and below the dam was not significantly different. Sedimentation of trout redds during the respective egg incubation periods could not be demonstrated. Embryo survival to hatching was positively correlated to stream temperatures and to a lesser extent, to intragravel D.O. concentration above 6 ppm. Stream temperatures and intragravel D.O. concentrations within redds were higher above the dam and resulted in significantly higher better overall survival to hatching than below the dam. An absence of heavy run-off and flooding during the 3 winters precluded any effect of the detention dam upon embryo survival, but the data provide a basis for future comparisons when winter flooding does occur.

80-002868 Febinger, D. L. EFFECTS OF WINTER CONDITONS ON FISH POPULATIONS IN LEFT-HAND CREEK, COLORADO: A PRELIMINARY REPORT. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:5-9. 1980. Available @$5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[841A 20th St., Boulder, CO 80302] Population dynamics and physiological changes of fishes in response to winter conditions are currently being investigated in a front range mountain stream to better understand causes of winter mortality. Two sections of Left-Hand Creek, Boulder County, Colorado are being studied. A lower, fourth order section, elevation 1850 m, average

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

80-002868 CONTINUED width 9.3m, had small late-autumn populations of stocked rainbow trout (43/surface ha), wild rainbow trout (215/surface ha) and longnose suckers (86/surface ha). A large brook trout population (3900/surface ha) made up of many small individuals was present at the upper, third order site, elevation 2400 m, average width 4.4 m. Biomass at the upper site (78 kg/surface ha) was 5.7 times that at the lower site (13.7 kg/surface ha). Stocked rainbow trout were in good condition (k=1.4) from October to February, fed actively and maintained a high fat wt/dry wt ratio (0.25). Brook trout were in poor condition in the fall (k=1.07), ate very little and showed a slight decline in condition through February (k=0.97). Greatest decline in condition occurred for longnose suckers with k going from 1.24 in October to 1.09 in February. Fat wt/dry wt for both brook trout and longnose suckers remained around 0.10. No significant change in fat content was observed for any species through February.

80-002869 Jackson, P. D. and W. D. Williams. EFFECTS OF BROWN TROUT, *SALMO TRUTTA* L., ON THE DISTRIBUTION OF SOME NATIVE FISHES IN THREE AREAS OF SOUTHERN VICTORIA. *Aust. J. Mar. Freshwater Res.* 31(1):61-67. Mar. 1980. SFA 25(4)

[Zool. Dep., Monash Univ, Clayton, Victoria 3168, Australia] Eight species of native fish and two of introduced fish were found during studies of the distribution of fishes in streams in three areas of southern Victoria, namely in the upper part of the catchment of the Yarra River, in the Otway Ranges, and on Wilsons Promontory. *S. trutta* does not occur on Wilsons Promontory but does occur in the other two areas. Results provide circumstantial evidence that *S. trutta* has deleteriously affected the occurence of *Galaxias olidus* and possibly *G. brevipinnis*. Some native fishes appear able to coexist with *S. trutta*.

80-002870 Naiman, R. J. DESERT FISHES AND THE AQUATIC HABITAT: AN ECOSYSTEM APPROACH. *Bull. Ecol. Soc. Am.* 61(2):104. June 1980. Abstract only. SFA 25(4)

[Woods Hole Oceanogr. Inst., Woods Hole, MA] During the past 125 years, the aquatic habitats and fish fauna of American deserts have undergone considerable change. Several endemic species have become extinct and many others have been either locally exterminated or are so endangered that they too, may disappear. The deterioration of the native fish fauna and the massive alteration of their ecosystems can be attributed to construction of damns, water diversions, pollution, mining of groundwater, and the introduction of exotic species. Such interference with delicate and complex ecosystems has been strongly reflected by the fish fauna. Despite these alterations, much has been learned about relationships between these fishes and their ecosystems. Basic principles of ecology and physiology operate here as they do for systems in humid areas. The environments range from constant temperature springs and cold, clear streams, to turbid rivers, hypersaline pools, desiccating lakes, and intermittent streams. Many have fragile watersheds that are extensive when compared to similar bodies of water in humid regions. Other habitats, such as springs and marshes, depend upon vast underground aquifers remaining from the last glacial period. Fishes in desert regions, largely derived from oceanic stocks or relicts from previous pluvial periods, have evolved morphological, physiological, and life history strategies that are closely tuned to their environment. In large rivers, fishes can tolerate extreme fluctuations of salinity and temperature but have been unable to alter their physiological resistance during critical portions of their life cycle. For all fishes, environmental variability and producivity affect life history strategies, behavior, population size, distribution, and community structure.

80-002871 Prikhod'ko, B. I. RELATIONSHIP BETWEEN ABUNDANCE OF YOUNG CASPIAN "ANCHOVY KILKA", *CLUPEONELLA ENGRAULIFORMIS*, AND WATER TEMPERATURE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):86-95.

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

80-002871 CONTINUED 1979. SFA 25(4)
[KaspNIRKh, Astrakhan, USSR] The connection between the yield of young of the Caspian "anchovy kilka", *Clupeonella engrauliformis*, and water temperature in different seasons is examined. The increased spawning intensity of the anchovy kilka in the east of the Caspian, where its young are found in winter in the streams of a warm current, is an adaptation of the species for the increased survival of progeny.

80-002872 Rahel, F. J. and J. J. Magnuson. pH AND FISH SPECIES RICHNESS IN BOG LAKES. *Bull. Ecol. Soc. Am.* 61(2):87. June 1980. Abstract only. SFA 25(4)
[Univ. Wis., Madison] Bog lakes are common in northern latitudes, forming a unique biotope characterized by low pH, excessive detritus accumulation and a distinctive littoral plant community. Such lakes in northern Wisconsin have an impoverished fish fauna dominated by yellow perch (*Perca flavescens*) and several centrarchids. To determine which habitat factors contribute to the low diversity of fishes, we sampled naturally acidic lakes ranging in pH from 4.4 to 6.9. Lakes were chosen so as to separate low pH from other factors which might limit species richness such as lack of hard bottom substrate, sparse submerged vegetation, the absence of inlets/outlets and the presence of abundant piscivores. Species richness was uncorrelated with pH, indicating that lack of suitable spawning habitat and interactions with predators were more important than low pH in excluding species from bog lakes. Only in bog lakes without large, fish predators did pH affect species richness. Such lakes were dominated by cyprinids at pH's above 5.0 but contained only mudminnows (*Umbra limi*) at pH's below 5.0.

80-002873 Sale, P. F. ASSEMBLAGES OF FISH ON PATCH REEFS--PREDICTABLE OR UNPREDICTABLE? *Environ. Biol. Fishes* 5(3):243-249. 29 Sept. 1980. SFA 25(4)
[Sch. Biol. Sci., Univ. Sydney, Sydney, N.S.W. 2006, Australia] The structure of assemblages of fish on small patch reefs was experimentally investigated by totally denuding three experimental reefs, and following their 'recovery' and concomitant changes in three control reefs by subsequent visual censusing. Experimental treatment had no significant effect on the number of fish or species subsequently present, nor on the faunal composition of the assemblages. However, all assemblages, both control and experimental, exhibited significant change in structure through the 28 month period they were followed. Such assemblages thus appear to have low constancy, or stability, but high resilience. The results conform to those of previous small-scale or artificial reef studies, and are compatible with a view emphasising the role of variability in recruitment in determining the structure of reef fish assemblages.

80-002874 Tonn, W. M. and J. J. Magnuson. PATTERNS IN THE ASSEMBLY AND DIVERSITY OF FISH COMMUNITIES IN NORTHERN WISCONSIN LAKES. *Bull. Ecol. Soc. Am.* 61(2):87. June 1980. Abstract only. SFA 25(4)
[Univ. Wis., Madison] Fish community structure patterns were examined in winter and summer for 18 small lakes in northern Wisconsin. Study lakes were chosen along gradients of environmental disturbance, productivity, lake area and watershed size. Multivariate analyses helped discern two community types, "mudminnow-cyprinid" and "centrarchid-pike." Each type was distinct with regards to species composition and seasonal changes in composition. Multivariate analyses showed that environmental characteristics of lakes occupied by each community type differed consistently. Oxygen concentration in winter, interacting with the availability of refuges through migration, appeared central to the determination of the community types. Conditions similar to those predicted for islands at equilibrium seemed responsible for differences in species richness within centrarchid-pike assemblages. For mudminnow-cyprinid assemblages, the data suggested that a disturbance related mechanism helped maintain the greater than predicted numbers of species in the richer assemblages.

IDENTIFICATION, KEYS, CLASSIFICATION

80-002875 Badcock, J. and R. C. Baird. REMARKS ON SYSTEMATICS, DEVELOPMENT, AND DISTRIBUTION OF THE HATCHETFISH GENUS *STERNOPTYX* (PISCES, STOMIATOIDEI). *NOAA Fish. Bull.* 77(4):803-820. 1980. SFA 25(4)
[Inst. Oceanogr. Sci., Wormley, Godaliming, Surrey, England]

80-002876 Banister, K. E. and M. A. Clarke. A REVISION OF THE LARGE *BARBUS* (PISCES, CYPRINIDAE) OF LAKE MALAWI WITH A RECONSTRUCTION OF THE HISTORY OF THE SOUTHERN AFRICAN RIFT VALLEY LAKES. *J. Nat. Hist.* 14(4):483-542. July-Aug. 1980. SFA 25(4)
[Dep. Zool., Brit. Mus. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-002877 Borodulina, O. D. COMPOSITION OF THE "*POLYIPNUS SPINOSUS* SPECIES COMPLEX" (STERNOPTYCHIDAE, OSTEICHTYES) WITH A DESCRIPTION OF THREE NEW SPECIES OF THIS GROUP. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):1-10. 1979. SFA 25(4)
[P.P. Shirshov Inst. Oceanol., USSR Acad. Sci., Moscow, USSR]

80-002878 Branstetter, S. and R. L. Shipp. OCCURRENCE OF THE FINETOOTH SHARK, *CARCHARHINUS ISODON*, OFF DAUPHIN ISLAND, ALABAMA. *NOAA Fish. Bull.* 78(1):177-179. 1980. SFA 25(4)
[Univ. South Ala., Dauphin Island Sea Lab., P.O. Box 386, Dauphin Island, AL 36528]

80-002879 Collette, B. B. and J. L. Russo. *SCOMBEROMORUS MUNROI*, A NEW SPECIES OF SPANISH MACKEREL FROM AUSTRALIA AND NEW GUINEA. *Aust. J. Mar. Freshwater Res.* 31(2):241-250. Apr. 1980. SFA 25(4)
[Syst. Lab, NMFS, Natl. Mus. Nat. Hist., Washington, DC 20560]

80-002880 Duggins, C. F., Jr. SYSTEMATICS AND ZOOGEOGRAPHY OF *LUCANIA PARVA*, *FLORIDICHTHYS*, AND *MENIDIA* (OSTEICHTHYES: ATHERINIFORMES) IN FLORIDA, THE GULF OF MEXICO AND YUCATAN. *Ph.D. dissertation, Fla. State Univ.* 182p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(3):849. Sept. 1980. SFA 25(4)

80-002881 Forey, P. L. *LATIMERIA*: A PARADOXICAL FISH. *Proc. R. Soc. Lond. B Biol. Sci.* 208(1172):369-384. 17 July 1980. SFA 25(4)
[Dep. Palaeontol., Brit. Mus. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-002882 Fritzsche, R. A. and G. D. Johnson. EARLY OSTEOLOGICAL DEVELOPMENT OF WHITE PERCH AND STRIPED BASS WITH EMPHASIS ON IDENTIFICATION OF THEIR LARVAE. *Trans. Am. Fish. Soc.* 109(4):387-406. July 1980. SFA 25(4)
[Dep. Fish., Humboldt State Univ., Arcata, CA 95521]

80-002883 Leiby, M. M. and R. W. Yerger. THE GENUS *BASCANICHTHYS* (PISCES: OPHICHTHIDAE) IN THE GULF OF MEXICO. *Copeia* 1980(3):402-408. 6 Sept. 1980. SFA 25(4)
[Fla. Dep. Nat. Resour., 100 Eighth Ave., SE, St. Petersburg 33701]

IDENTIFICATION, KEYS, CLASSIFICATION (CONTINUED)

80-002884 Litvinenko, N. I. *SEBASTES FASCIATUS KELLYI* (SCORPAENIDAE) FROM COASTAL WATERS OFF EASTPORT MAINE, USA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):1-14. 1979. SFA 25(4)
[Perm Univ., Zool. Inst., USSR Acad. Sci., Leningrad, USSR]

80-002885 Pietsch, T. W. and J. P. Van Duzer. SYSTEMATICS AND DISTRIBUTION OF CERATIOID ANGLERFISHES OF THE FAMILY MELANOCETIDAE WITH THE DESCRIPTION OF A NEW SPECIES FROM THE EASTERN NORTH PACIFIC OCEAN. *NOAA Fish. Bull.* 78(1):59-87. 1980. SFA 25(4)
[Coll. Fish., Univ. Wash., Seattle 98195]

80-002886 Powles, H. DESCRIPTIONS OF LARVAL SILVER PERCH, *BAIRDIELLA CHRYSOURA*, BANDED DRUM, *LARIMUS FASCIATUS*, AND STAR DRUM, *STELLIFER LANCEOLATUS* (SCIAENIDAE). *NOAA Fish. Bull.* 78(1):119-136. 1980. SFA 25(4)
[Pech. Oceans, Div. Sci., C.P. 15500, Quebec G1K 7Y7, Canada]

80-002887 Roberts, T. R. A REVISION OF THE ASIAN MASTACEMBELID FISH GENUS *MACROGNATHUS*. *Copeia* 1980(3):385-391. 6 Sept. 1980. SFA 25(4)
[Tiburon Cent. Environ. Stud., P.O. Box 855, Tiburon, CA 94920]

80-002888 Shaboneyev, I. Ye. and A. N. Kotlyar. A COMPARATIVE MORPHOECOLOGICAL ANALYSIS OF THE EASTERN PACIFIC FORMS OF *TRACHURUS SYMMETRICUS* AND THE ATLANTIC OCEANIC HORSE MACKEREL, *TRACHURUS PICTURATUS PICTURATUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(2):24-29. 1979. SFA 25(4)
[VNIRO, Moscow, USSR]

80-002889 Smith, M. L. and R. R. Miller. *ALLOTOCA MACULATA*, A NEW SPECIES OF GOODEID FISH FROM WESTERN MÉXICO, WITH COMMENTS ON *ALLOTOCA DUGESI*. *Copeia* 1980(3):408-417. 6 Sept. 1980. SFA 25(4)
[Mus. Zool., Univ. Mich., Ann Arbor 48109]

80-002890 Smith, M. L. and R. R. Miller. SYSTEMATICS AND VARIATION OF A NEW CYPRINODONTID FISH, *CYPRINODON FONTINALIS*, FROM CHIHUAHUA, MEXICO. *Proc. Biol. Soc. Wash.* 93(2):405-416. 28 Aug. 1980. SFA 25(4)
[Div. Biol. Sci., Univ. Mich., Ann Arbor 48109]

80-002891 Steyskal, G. C. THE GRAMMAR OF FAMILY-GROUP NAMES AS EXEMPLIFIED BY THOSE OF FISHES. *Proc. Biol. Soc. Wash.* 93(1):168-177. 9 July 1980. SFA 25(4)
[Natl. Mus. Nat. Hist., Washington, DC 20560]

80-002892 Volobuyev, V. V.; Ye. D. Vasil'yeva and K. A. Savvaitova. THE SYSTEMATIC STATUS OF THE DIADROMOUS "CHUKCHI CHAR" OF THE GENUS *SALVELINUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):21-30. 1979. SFA 25(4)
[Magadan Dep., Pac. Res. Inst. Sea Fish. Oceanogr., USSR]

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[Dep. Biol., Va. Commonwealth Univ., Richmond 23284]

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[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

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[Dep. Ichthyol. Herpetol., Royal Ontario Mus., 100 Queens Park, Toronto, ON M5S 2C6, Canada]

80-002896 Winterbottom, R. SYSTEMATICS, OSTEOLOGY AND PHYLOGENETIC RELATIONSHIPS OF FISHES OF THE OSTARIOPHYSAN SUBFAMILY ANOSTOMINAE (CHARACOIDEI, ANOSTOMIDAE). *R. Ont. Mus. Life Sci. Contrib.* 123. 112p. 1980. SFA 25(4)
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PARASITES AND DISEASES-GENERAL

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[Estac. Piscicult., Esc. Agron., Univ. Centro-Occidental, Apt. Correos No. 400, Barquisimeto, Edo. Lara, Venezuela]

80-002900 Burn, P. R. THE PARASITES OF SMOOTH FLOUNDER, *LIOPSETTA PUTNAMI* (GILL), FROM THE GREAT BAY ESTUARY, NEW HAMPSHIRE. *J. Parasitol.* 66(3):532-541. June 1980. SFA 25(4)
[Osborn Lab. Mar. Sci., N.Y. Aquarium, N.Y. Zool. Soc., Boardwalk at W. 8th St., Brooklyn 11224]

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[INRA, Fish Dis. Lab., Virol. Immunol. Res. Stn., 78850 Thiverval-Grignon, France]

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[Tift Coll., Forsyth, GA 31029]

BACTERIAL DISEASES

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[Wash. Dep. Fish., Olympia 98504]

80-002904 Beckwith, D. G. and R. G. Malsberger. KIDNEY TUMOUR VIRUS--TUMOUR OR MYCOBACTERIAL TUBERCLE? *J. Fish Dis.* 3(4):339-348. July 1980. SFA 25(4)
[Microbiol. Div., Dep. Pathol., St. Luke's Hosp., Bethelehem, PA 18015] Bacteriologically sterile filtrates of 'tumourous' fish elicited formation of 'tumours' *in vivo* which were morphologically indistinguishable from those described by Wessing & Bargen (1959). Attempts to isolate the putative aetiologic 'virus' in primary and established cell cultures failed. When the lesions were examined for other compatible aetiologies, acid-fast stains revealed acid-fast bacilli and cultures grew *Mycobacterium fortuitum*. It is suggested that the 'kidney tumour virus' is actually soluble mycobacterial cell-fractions capable of eliciting tubercle formation *in vivo*.

80-002905 Cone, D. K.; J. D. Miller and W. K. Austin. THE PATHOLOGY OF "SADDLEBACK" DISEASE OF UNDERYEARLING ATLANTIC SALMON (*SALMO SALAR*). *Can. J. Zool.* 58(7):1283-1287. July 1980. In English with French summ. SFA 25(4)
[Dep. Biol., Univ. New Brunswick, Fredericton, NB E3B 5A3, Canada]

80-002906 Hilton, L. R. and J. L. Wilson. TERRAMYCIN-RESISTANT *EDWARDSIELLA TARDA* IN CHANNEL CATFISH. *Prog. Fish-Cult.* 42(3):159. July 1980. SFA 25(4)
[TVA, Norris, TN 37828]

80-002907 Itami, T. and R. Kusuda. [STUDIES ON SPRAY VACCINATION AGAINST VIBRIOSIS IN CULTURED AYU--I. EFFECT OF BENTONITE AND pH ON VACCINATION EFFICACY.] *Bull. Jpn. Soc. Sci. Fish.* 46(5):533-536. May 1980. In with English summ. SFA 25(4)
[Dep. Cult. Fish., Fac. Agric., Kochi Univ., Nankoku, Kochi Pref. 783, Japan] Differences in efficacy among bentonite-added and/or pH-adjusted vaccines for spray vaccination against vibriosis in cultured ayu, *Plecoglossus altivelis* were investigated. *Vibrio anguillarum*, the etiological agent of vibriosis in ayu, was incubated in nutrient broth with shaking for 96 h at 25°C. Then the culture was inactivated with 0.5% formalin for 24h at 20°C. Five kinds of vaccine used in this study were GOULD'S vaccine, bentonite-added vaccine, pH-adjusted vaccine, formalin-killed vaccine and cell-free vaccine. Experimental groups of fish placed in dip net were sprayed with these vaccines at a pressure of 5 kg/cm^2 for 5-7 seconds by the sand blasting gun positioned 20-25 cm from fish. The artificial water-borne challenge with virulent *V. anguillarum* was carried out two weeks after vaccination. All except the cell-free vaccine were highly effective. From the experimental result the formalin-killed vaccine was also effective as well as GOULD's vaccine; it can be concluded that it is not necessary to add bentonite or to adjust pH of spray vaccine for the control of vibriosis in cultured ayu. All the fishes sprayed with

BACTERIAL DISEASES (CONTINUED)

80-002907 CONTINUED cell-free vaccine died two days after that of the control. This might indicate that cell-free vaccine contains the soluble antigens, which play a part in the protection of the pathogenic infection to some extent. Increase in agglutinating antibody titers of fish sera was observed in neither the immunized fish nor the control.

80-002908 Itami, T. and R. Kusuda. [STUDIES ON SPRAY VACCINATION AGAINST VIBRIOSIS IN CULTURED AYU--II. DURATION OF VACCINATION EFFICACY AND EFFECT OF DIFFERENT VACCINE PREPARATIONS.] *Bull. Jpn. Soc. Sci. Fish.* 46(6):699-703. June 1980. In Japanese with English summ. SFA 25(4)

[Dep. Cult. Fish., Fac. Agric., Kochi Univ., Nankoku, Kochi 783, Japan] Duration of vaccination efficacy and effect of different vaccine preparations for control of vibriosis in cultured ayu, *Plecoglossus altivelis*, were investigated. *Vibrio anguillarum*, the etiological agent of vibriosis in ayu, was incubated in nutrient broth with shaking at 25°C. Vaccines used in this study were formalin-killed vaccine-96 and heat-killed vaccine, both were prepared from 96h culture; and ultrasonicated vaccine and formalin-killed vaccine-48, were both prepared from 48h culture. Procedures of spray vaccination and artificial water-borne challenge were the same as reported previously. In the study on the duration of vaccination efficacy, formalin-killed vaccine-96, which was the most effective in the previous report, was used. Efficacy was maintained for 16 weeks, so that booster is unnecessary during almost the whole period of culturing ayu after spray vaccine is administed once. To examine the effect of different vaccine preparations, four kinds of vaccine described above were used. Formalin-killed vaccine-96 was the most effective among them and formalin-killed vaccine-48 was the least. But ultrasonicated vaccine had almost the same efficacy as formalin-killed vaccine-96. On the basis of these results, disrupted cell walls and released components are considered to be protective antigens against vibrio infection. Heat-killed vaccine was less effective than formalin-killed vaccine-96; however, it was still effective. Therefore, heat resistant antigens are considered to play an important role int the protection against vibriosis.

80-002909 Iwama, G. K. INCUBATION TIMES RESULTING FROM EXPERIMENTAL INJECTIONS OF KIDNEY DISEASE BACTERIA INTO JUVENILE COHO SALMON. *Prog. Fish-Cult.* 42(3):182-183. July 1980. SFA 25(4)

[Fish Wildl. Br., Minist. Environ., 400, 1019 Wharf St., Victoria, BC V8W 2Y9, Canada]

80-002910 Sakai, D. K. [INVASIVE ROUTES OF *AEROMONAS SALMONICIDA* SUBSP. *SALMONICIDA*. *Sci. Rep. Hokkaido Fish Hatchery* No. 34. p. 1-6. Dec. 1979. In Japanese with English summ. SFA 25(4)

[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan]

80-002911 Winter, G. W.; C. B. Schreck and J. D. McIntyre. RESISTANCE OF DIFFERENT STOCKS AND TRANSFERRIN GENOTYPES OF COHO SALMON, *ONCORHYNCHUS KISUTCH*, AND STEELHEAD TROUT, *SALMO GAIRDNERI*, TO BACTERIAL KIDNEY DISEASE AND VIBRIOSIS. *NOAA Fish. Bull.* 77(4):795-802. 1980. SFA 25(4)

[Oreg. Coop. Fish. Res. Unit, Oreg. State Univ., Corvallis 97331] Juvenile coho salmon and steelhead trout of different stocks and three transferrin genotypes (AA, AC and CC), all reared in identical or similar environments, were experimentally infected with *Corynebacterium* sp., the causative agent of bacterial kidney disease, or with *Vibrio anguillarum*, the causative agent of vibriosis. Mortality due to the pathogens was compared among stocks within a species and among transferrin genotypes within a stock to determine whether there was a genetic basis for resistance to disease.

BACTERIAL DISEASES (CONTINUED)

80-002911 CONTINUED Differences in resistance to bacterial kidney disease among coho salmon stocks had a genetic basis. Stock susceptibility to vibriosis was strongly influenced by environmental factors. Coho salmon or steelhead trout of one stock may be resistant to one disease by susceptible to another. The importance of transferrin genotype fo coho salmon in resistance to bacterial kidney disease was stock specific; in stocks that showed differential resistance of genotypes, the AA was the most susceptible. No differences in resistance to vibriosis were observed among transferrin genotypes.

PROTOZOAN DISEASES

80-002912 Booker, O. J. and W. L. Current. ULTRASTRUCTURE OF *MYXOBILATUS* SP. (MYXOSPORIDA) IN THE LARGEMOUTH BASS. *J. Ala. Acad. Sci.* 51(3):184. July 1980. Abstract only. SFA 25(4)
[Dep. Zool.-Entomol., Auburn Univ., Auburn, AL 36830]

80-002913 Canning, E. U. and J. P. Nicholas. GENUS PLEISTOPHORA (PHYLUM MICROSPORA): REDESCRIPTION OF THE TYPE SPECIES, *PLEISTOPHORA TYPICALIS* GURLEY, 1893 AND ULTRASTRUCTURAL CHARACTERIZATION OF THE GENUS. *J. Fish Dis.* 3(4):317-338. July 1980. SFA 25(4)
[Imperial Coll., Silwood Park, Ascot, Berkshire SL5 7PY, England]

80-002914 Cheung, P. J.; R. F. Nigrelli and G. D. Ruggieri. STUDIES ON THE MORPHOLOGY OF *URONEMA MARINUM* DUJARDIN (CILIATEA: URONEMATIDAE) WITH A DESCRIPTION OF THE HISTOPATHOLOGY OF THE INFECTION IN MARINE FISHES. *J. Fish Dis.* 3(4):295-303. July 1980. SFA 25(4)
[Osborn Lab. Mar. Sci., N.Y. Aquarium, N.Y. Zool. Soc., Brooklyn 11224]

80-002915 Dyková, I. and J. Lom. TISSUE REACTIONS TO MICROSPORIDIAN INFECTIONS IN FISH. *J. Fish Dis.* 3(4):265-283. July 1980. SFA 25(4)
[Inst. Parasitol., Czech. Acad. Sci., Flemengovo nám. 2, 166 32 Praha 6, Czechoslovakia]

80-002916 Sanaullah, M. and A. T. A. Ahmed. GILL MYXOBOLIASIS OF MAJOR CARPS IN BANGLADESH. *J. Fish Dis.* 3(4):349-354. July 1980. SFA 25(4)
[Aquacult. Exp. Stn., Mymensingh, Bangladesh]

80-002917 Solangi, M. A. and R. M. Overstreet. BIOLOGY AND PATHOGENESIS OF THE COCCIDIUM *EIMERIA FUNDULI* INFECTING KILLIFISHES. *J. Parasitol.* 66(3):513-526. June 1980. SFA 25(4)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

VIRAL DISEASES

80-002918 Bowser, P. R. and J. A. Plumb. CHANNEL CATFISH VIRUS: COMPARATIVE REPLICATION AND SENSITIVITY OF CELL LINES FROM CHANNEL CATFISH OVARY AND THE BROWN BULLHEAD. *J. Wildl. Dis.* 16(3):451-454. July 1980.

VIRAL DISEASES (CONTINUED)

80-002918 CONTINUED SFA 25(4)
[Univ. Calif., Bodega Mar. Lab., P.O. Box 247, Bodega Bay 94923] A cell line derived from channel catfish ovary tissue was compared with the brown bullhead (BB) cell line for their respective abilities to replicate and detect channel catfish virus (CCV). The channel catfish ovary cell line (CCO) produced cytopathic effects (CPE) more rapidly and detected CCV at higher dilutions than did the BB cell line. Produciton of CCV was more rapid in CCO cells than in BB cells, but the peak titers of the two lines were not significantly different. The CCO cell line was shown to be the more sensitive cell line for CCV research and diagnostics.

80-002919 Kelly, R. K.; H. R. Miller; O. Nielsen and J. W. Clayton. FISH CELL CULTURE: CHARACTERISTICS OF A CONTINUOUS FIBROBLASTIC CELL LINE FROM WALLEYE (*STIZOSTEDION VITREUM VITREUM*). *Can. J. Fish. Aquatic Sci.* 37(7):1070-1075. July 1980. SFA 25(4)
[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada]

80-002920 Schwedler, T. E. CHARACTERISTICS OF A NEW VIRUS FROM GOLDEN SHINERS, *NOTEMIGONUS CRYSOLEUCAS*. *Ph.D. dissertation, Auburn Univ.* 70p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(1):8. July 1980. SFA 25(4)

80-002921 Watanabe, T.; K. Tanaka; O. Tamura; Y. Nakagawa and K. Takahashi. FINE STRUCTURE OF THE NORMAL AND VIRUS-INFECTED CELLS DERIVED FROM THE KIDNEY OF YAMAE, *ONCORHYNCHUS MASOU*. *Bull. Jpn. Soc. Sci. Fish.* 46(4):401-406. Apr. 1980. SFA 25(4)
[Sch. Fish. Sci., Kitasato Univ., Okirai, Sanrikee-cho, Iwate 022-01, Japan]

OTHER DISEASES AND PARASITES

80-002922 Bell, D. A. and M. Beverley-Burton. PREVALENCE AND INTENSITY OF *CAPILLARIA CATOSTOMI* (NEMATODA: TRICHUROIDEA) IN WHITE SUCKER (*CATOSTOMUS COMMERSONI*) IN SOUTHERN LAKE HURON, CANADA. *Environ. Biol. Fishes* 5(3):267-271. 29 Sept. 1980. SFA 25(4)
[Minist. Nat. Resour., 322 Kent St. West, Lindsay, ON K9V 2Z9, Canada]

80-002923 Benz, G. W. and W. J. Pohley. A CONSPICUOUS *PHILOMETRA* SP. (NEMATODA: PHILOMETRIDAE) FROM THE OCULO-ORBITS OF CENTRARCHID FISHES. *Proc. Helminthol. Soc. Wash.* 47(2):264-266. July 1980. SFA 25(4)
[Dep. Zool., Univ. Md., College Park 20742]

80-002924 Caballero C., E. and G. Caballero R. ESTUDIOS DE LA COLLECCIÓN DE TREMÁTODOS COLECTADOS POR HOWARD A. WINTER EN PECES DEL OCÉANO PACIFICO DE MÉXICO Y DE LOS ESTADOS UNIDOS DE NORTE AMÉRICA. VI. [STUDIES OF THE TREMATODES COLLECTED BY HOWARD A. WINTER IN FISH FROM THE PACIFIC OCEAN OF MEXICO AND THE UNITED STATES. VI.] *Rev. Biol. Trop.* 24(2):229-234. Dec. 1976. In Spanish with English summ. SFA 25(4)
[Apt. Post. No. 692, Mexico 1, D.F., Mexico]

80-002925 Caballero C., E. and G. Caballero R. ESTUDIO DE LA COLECCIÓN DE TREMÁTODOS COLECTADOS POR HOWARD A. WINTER EN PECES DEL OCÉANO PACÍFICO DE MÉXICO Y DE LOS ESTADOS UNIDOS DE NORTE AMÉRICA. V.

OTHER DISEASES AND PARASITES (CONTINUED)

80-002925 CONTINUED [STUDIES OF THE TREMATODES COLLECTED BY HOWARD A. WINTER IN FISH FROM THE PACIFIC OCEAN OF MEXICO AND THE UNITED STATES. V.] *Rev. Biol. Trop.* 24(2):191-198. Dec. 1976. In Spanish with English summ. SFA 25(4)
[Apt. Post. No. 692, Mexico 1, D.F., Mexico]

80-002926 Campbell, R. A. and J. Carvajal G. *ECHINOBOTHRIUM EUZETI*, A NEW CESTODE FROM THE SPIRAL VALVE OF A CHILEAN ELASMOBRANCH. *Proc. Helminthol. Soc. Wash.* 47(2):165-167. July 1980. SFA 25(4)
[Dep. Biol., Southeast Mass. Univ., North Dartmouth 02747]

80-002927 Curtis, M. A. and M. E. Rau. THE GEOGRPHICAL DISTRIBUTION OF DIPLOSTOMIAS (TREMATODA: STRIGEIDAE) IN FISHES FROM NORTHERN QUEBEC, CANADA, IN RELATION TO THE CALCIUM ION CONCENTRATIONS OF LAKES. *Can. J. Zool.* 58(7):1390-1394. July 1980. In English with French summ. SFA 25(4)
[Inst. Parasitol., McGill Univ., Macdonald Coll., Ste. Anne de Bellevue, PQ H9X 1C0, Canada]

80-002928 Deardorff, T. L. and R. M. Overstreet. TAXONOMY AND BIOLOGY OF NORTH AMERICAN SPECIES OF *GOEZIA* (NEMATODA: ANISAKIDAE) FROM FISHES, INCLUDING THREE NEW SPECIES. *Proc. Helminthol. Soc. Wash.* 47(2):192-217. July 1980. SFA 25(4)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

80-002929 Dubinina, M. N. TAPEWORMS (CESTODA, LIGULIDAE) OF THE FAUNA OF THE USSR. *Amerind Publ. Co. Pvt. Ltd., New Delhi, India* 320p. 1980. Available from U.S. Dep. Commerce, NTIS, Springfield, VA 22161]

80-002930 Fischthal, J. H. SOME DIGENETIC TREMATODES OF MARINE FISHES FROM ISRAEL'S MEDITERRANEAN COAST AND THEIR ZOOGEOGRPAHY, ESPECIALLY THOSE FROM RED SEA IMMIGRANT FISHES. *Zool. Scr.* 9(1):11-23. 1980. SFA 25(4)
[Dep. Biol. Sci., State Univ. N.Y., Binghamton]

80-002931 Goven, B. A.; J. P. Gilbert and J. B. Gratzek. APPARENT DRUG RESISTANCE TO THE ORGANOPHOSPHATE DIMETHYL (2,2,2-TRICHLORO-1-HYDROXYETHYL) PHOSPHONATE BY MONOGENETIC TREMATODES. *J. Wildl. Dis.* 16(3):343-346. July 1980. SFA 25(4)
[J. B. Gratzek: Dep. Med. Microbiol., Univ. Ga., Athens 30602] *Grodactylus elegans* on goldfish, (*Carassius auratus*) from a commercial farm were resistant to recommended dosages of dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate. Controlled experiments suggest that a dosage 100 times the commonly recommended minimal dosage (.25 mg/l) was required to remove trematodes. A hypothesis is proposed to account for the development of drug resistant trematodes based on the life cycle of the parasites and continual drug exposure.

80-002932 Lankester, M. W. and J. D. Smith. HOST SPECIFICITY AND DISTRIBUTION OF THE SWIM-BLADDER NEMATODES, *CYSTIDICOLA FARIONIS* FISCHER, 1798 AND *C. CRISTIVOMERI* WHITE, 1941 (HABRONEMATOIDEA), IN SALMONID FISHES OF ONTARIO. *Can. J. Zool.* 58(7):1298-1305. July 1980. In English with French summ. SFA 25(4)
[Dep. Biol., Lakehood Univ., Thunder Bay, ON P7B 5E1, Canada]

80-002933 Madhavi, R. LIFE HISTORY OF *ALLOCREADIUM HANDIAI* PANDE, 1937 (TREMATODA: ALLOCREADIIDAE) FROM THE FRESHWATER FISH *CHANNA PUNCTATA* BLOCH. *Z. Parasitenkd.* 63(1):89-97. Aug. 1980. SFA 25(4)
[Dep. Zool., Andhra Univ., Waltair 530003, India]

OTHER DISEASES AND PARASITES (CONTINUED)

80-002934 Muzzall, P. M. SEASONAL DISTRIBUTION AND ECOLOGY OF THREE CARYOPHYLLAEID CESTODE SPECIES INFECTING WHITE SUCKERS IN SE NEW HAMPSHIRE. *J. Parasitol.* 66(3):542-550. June 1980. SFA 25(4)
[Dep. Nat. Sci., Kedzie Lab., Mich. State Univ., East Lansing 48824]

80-002935 Russell, L. R. EFFECTS OF *TRUTTAEDACNITIS TRUTTAE* (NEMATODA: CUCULLANIDAE) ON GROWTH AND SWIMMING OF RAINBOW TROUT, *SALMO GAIRDNERI*. *Can. J. Zool.* 58(7):1220-1226. July 1980. In English with French summ. SFA 25(4)
[Dep. Fish. Oceans, 1090 W. Pender St., Vancouver, BC V6E 2P1, Canada]

80-002936 Skorping, A. POPULATION BIOLOGY OF THE NEMATODE *CAMALLANUS LACUSTRIS* IN PERCH, *PERCA FLUVIATILIS* L., FROM AN OLIGOTROPHIC LAKE IN NORWAY. *J. Fish Biol.* 16(5):483-492. May 1980. SFA 25(4)
[Univ. Tromso, Inst. Biol. Geol., P.O. Box 790 N-9001 Tromso, Norway]

80-002937 Whittaker, F. H. and J. Carvajal G. SCANNING ELECTRON MICROSCOPY OF SCOLICES OF SOME CESTODES FROM ELASMOBRANCHS. *Proc. Helminthol. Soc. Wash.* 47(2):256-259. July 1980. SFA 25(4)
[Dep. Biol., Univ. Louisville, Louisville, KY 40208]

80-002938 Williams, E. H., Jr. *ROGERSUS ROGERSI* GEN. ET SP. N. (CESTODA: CARYOPHYLLAEIDAE) FROM THE BLACKTAIL REDHORSE, *MOXOSTOMA POECILURUM* (JORDAN), (OSTEICHTHYES) IN THE SOUTHEASTERN UNITED STATES. *J. Parasitol.* 66(3):564-568. June 1980. SFA 25(4)
[Dep. Mar. Sci., Univ. Puerto Rico, Mayaguez 00708]

80-002939 Wootten, R. and D. C. Cann. ROUND WORMS IN FISH. *Torry Res. Stn. Advis. Note* No. 80. 6p. May 1980. SFA 25(4)
[Torry Res. Stn., P.O. Box 31, 135 Abbey Rd., Aberdeen AB9 8DG, Scotland]

POLLUTION

80-002940 Bastürk, O.; M. Dogan; I. Salihoglu and T. I. Balkas. DDT, DDE, AND PCB RESIDUES IN FISH, CRUSTACEANS AND SEDIMENTS FROM THE EASTERN MEDITERRANEAN COAST OF TURKEY. *Mar. Pollut. Bull.* 11(7):191-195. July 1980. SFA 25(4)
[T. I. Balkas: M.E.T.U. Mar. Sci. Dep., P.K. 28, Erdemli, Icel, Turkey]

80-002941 Buggiani, S. S. and C. Vannuchi. MERCURY AND LEAD CONCENTRATIONS IN SOME SPECIES OF FISH FROM THE TUSCAN COASTS (ITALY). *Bull. Environ. Contam. Toxicol.* 25(1):90-92. July 1980. SFA 25(4)
[Inst. Gen. Pathol. Pathol. Anat., Vet. Med., Univ. Pisa, via delle Piagge, 2, Pisa, Italy]

80-002942 Hildebrand, S. G.; R. H. Strand and J. W. Huckabee. MERCURY ACCUMULATION IN FISH AND INVERTEBRATES OF THE NORTH FORK HOLSTON RIVER, VIRGINIA AND TENNESSEE. *J. Environ. Qual.* 9(3):393-400. July-Sept. 1980. SFA 25(4)
[Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

POLLUTION (CONTINUED)

80-002943 Hudson, P. L. and S. J. Nichols. RELATION BETWEEN ZOOPLANKTON MIGRATION AND ENTRAINMENT IN A SOUTH CAROLINA COOLING RESERVOIR. *Proc. Waste Heat Manage. Util. Conf.* 26:1-15. 1979. SFA 25(4)

[U.S. FWS, Southeast Reservoir Invest., 206 Hwy. 123 Bypass, Clemson, SC 29631] Knowledge of the vertical and areal distribution of zooplankton could be used to influence the siting and design of intake structures for condenser cooling water systems of steam-electric and hydroelectric power stations. We studied the vertical distribution of zooplankton in Keowee Reservoir, South Carolina, a cooling reservoir for a 2580-MW nuclear power plant. The nuclear plant withdraws hypolimnetic water from depths of 20-27 m, beneath a surface skimmer wall for once-through condenser cooling. Diel and seasonal variations in vertical distributions of zooplankton influenced the degree of entrainment at the power plant. For about 9 months, zooplankton was surface oriented, and only relatively small amounts were entrained. During July, August and September, however, most zooplankters were bottom-oriented during the day, and large numbers were entrained whereas at night most moved to or near the surface and few were entrained. The danger of entrainment during these months was thus restricted largely to the 12 to 13 daylight hours.

80-002944 Ikeda, S. and T. Yokoi. FISH POPULATION DYNAMICS UNDER NUTRIENT ENRICHMENT--A CASE OF THE EAST SETO INLAND SEA. *Ecol. Model.* 10(3/4):141-165. Aug. 1980. SFA 25(4)

[Dep. Appl. Math. Phys., Fac. Eng., Kyoto Univ., Kyoto 606, Japan] The significant increase of pollutants in the sea and the slow exchange rate of sea water between the inland sea and the ocean have worsened the general environmental conditions in the Seto Inland Sea since the 1960s. In particular, the enormous amounts of nutrients such as nitrogen and phosphorus flowing into the sea seem to have had a wide range of effects on its fish population. In this paper, a theoretical model of fish population dynamics in the eutrophicated inland sea is proposed, based on the prey-predator relationship of the Lotka-Volterra type. This model is validated by checking the recent fishery statistics of the sea area. Specific attention is focused on the impact of nutrient enrichment on fish population dynamics.

80-002945 Jan, J. and S. Malneršič. CHLORINATED BENZENE RESIDUES IN FISH IN SLOVENIA (YUGOSLAVIA). *Bull. Environ. Contam. Toxicol.* 24(6):824-827. June 1980. SFA 25(4)

[Publ. Health Inst. Slovenia, Trubarjiva 2, Ljubljana, Yugoslavia]

80-002946 Mathur, D. and P. L. McCreight. EFFECTS OF HEATED EFFLUENT ON THE REPRODUCTIVE BIOLOGY OF WHITE CRAPPIE, *POMOXIS ANNULARIS* IN CONOWINGO POND, PENNSYLVANIA. *Arch. Hydrobiol.* 88(4):491-499. 1980. SFA 25(4)

[RMC Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518] One of the potential concerns relative to the effects of heated discharges on reproductive biology is the alteration in spawning times of fishes. The effects of operation of Peach Bottom Atomic Power Station on the spawning times of the white crappie, *Pomoxis annularis* were studied in Conowingo Pond, a 35.8 km^2 impoundment on the lower Susquehanna River, Pennsylvania. Seasonally, the water temperature in the thermal plume averaged 5.6 to 11.1°C above the ambient temperature. Although a high variability existed in gonosomatic indices of white crappie no consistent significant differences occurred between the preoperational (1971-1973) and postoperational (1974-1977) periods. There was no evidence of earlier spawning in the thermal plume than in the ambient areas as determined from gonosomatic ratios and larval fish catches. Temperature at peak spawning was similar among years and areas. However, the gonosomotic ratios of crappie collected in the thermal plume were slightly lower than those from the ambient areas.

POLLUTION (CONTINUED)

80-002947 Murray, L. A.; M. G. Norton; R. S. Nunny and M. S. Rolfe. THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 6. THE DISPOSAL OF SEWAGE SLUDGE AND INDUSTRIAL WASTE OFF THE RIVER HUMBER. *Minist. Agric. Fish. Res. Tech. Rep.* No. 55. 35p. 1980. SFA 25(4)
[Fish. Lab., Burnham-on-Crouch, England]

80-002948 Philippart, J. C. INCIDENCES DE LA POLLUTION ORGANIQUE ET DE L'EUTROPHISATION SUR LA FAUNE ICHTYOLOGIQUE DE LA SEMOIS. [THE EFFECTS OF ORGANIC POLLUTION AND EUTROPHICATION ON THE FISH FAUNA OF THE RIVER SEMOIS.] *Ann. Limnol.* 16(1):77-89. 1980. In French with English summ. SFA 25(4)
[Unit. Rech. Piscicoles, 22, Quai Van Beneden, B4020 Liège, Belgium]

80-002949 Sanders, H. L.; J. F. Grassle; G. R. Hampson; L. S. Morse; S. Garner-Price and C. C. Jones. ANATOMY OF AN OIL SPILL: LONG-TERM EFFECTS FROM THE GROUNDING OF THE BARGE *FLORIDA* OFF WEST FALMOUTH, MASSACHUSETTS. *J. Mar. Res.* 38(2):265-380. May 1980. SFA 25(3)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543] To determine carefully the effects on the marine and estuarine benthos of Number 2 fuel oil spilled by the barge *FLORIDA* off West Falmouth, Massachusetts, we sampled for many months along an onshore-offshore gradient of pollution, and less intensively at unoiled sites. Analyses of hydrocarbons established that pollution was greatest and most persistent in the intertidal and subtidal zones of Wild Harbor River, less severe in degree and duration at stations farthest from shore. A variety of concurrent analyses showed that disturbance of the fauna was most severe and longest lasting at the most heavily oiled sites, and least severe but perceptible at lightly oiled stations. Patterns of disturbance were not related to granulometry of the sediments. Plants, crustaceans, fish, and birds suffered both high mortality immediately after the spill, and physiological and behavioral abnormalities directly related to high concentrations of the fuel oil. Five years after the spill its effects on the biota were still detectable, and partly degraded #2 fuel oil was still present in the sediments in Wild Harbor River and estuary.

80-002950 Stout, V. F. ORGANOCHLORINE RESIDUES IN FISHES FROM THE NORTHWEST ATLANTIC OCEAN AND GULF OF MEXICO. *NOAA Fish. Bull.* 78(1):51-58. 1980. SFA 25(4)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-002951 Tanabe, S.; H. Tanaka; R. Tatsukawa and I. Nakamura. [ORGANOCHLORINE COMPOUND RESIDUES IN SEVERAL SPECIES OF FISHES CAUGHT OFF CHILE.] *Bull. Jpn. Soc. Sci. Fish.* 46(6):763-769. June 1980. In Japanese with English summ. SFA 25(4)
[Fac. Agric., Ehime Univ., 5-7, Tarumi-3, Matsuyama 790, Japan]

FISH KILLS

80-002952 Giussani, G.; R. De Bernardi; R. Mosello and P Ghittino. SITUAZIONE LIMNOLOGICA DE LAGO DI CANDIA (PIEMONTE) IN CONCOMITANZA CON UNA GRAVE MORTALITÀ ITTICA DA BRANCHIOMICOSI. [LIMNOLOGICAL FEATURES OF LAGO DI CANDIA (PIEDMONT, ITALY) DURING A HEAVY FISH MORTALITY BY BRANCHIOMYCOSIS.] *Riv. It. Piscic. Ittiop.* 15(2):46-52. Apr.-May-June 1980. In Italian with English summ. SFA 25(4)
[C.N.R. Ist. Ital. Idrobiol., 28048 Verbania Pollanza, Novara, Italy]

TOXICOLOGY; BIOASSAYS

80-002953 Förlin, L. EFFECTS OF CLOPHEN A50, 3-METHYLCHOLANTHRENE, PREGNENOLONE-16α-CARBONITRILE AND PHENOBARBITAL ON THE HEPATIC MICROSOMAL CYTOCHROME *P*-450-DEPENDENT MONOOXYGENASE SYSTEM IN RAINBOW TROUT, *SALMO GAIRDNERI*, OF DIFFERENT AGE AND SEX. *Toxicol. Appl. Pharmacol.* 54(3):420-430. July 1980. SFA 25(3)
[Dep. Zoophysiol., Univ. Göteborg, Fack, 400 33 Göteborg, Sweden]

80-002954 Müller, R. FISH TOXICITY AND SURFACE TENSION OF NON-IONIC SURFACTANTS: INVESTIGATIONS OF ANTIFOAM AGENTS. *J. Fish Biol.* 16(5):585-589. May 1980. SFA 25(4)
[Swiss Fed. Inst. Water Resour. Water Pollut. Control, Lake Res. Lab., CH-6047 Kastanienbaum, Switzerland] Fish toxicity of etho-nonylphenol and of two non-ionic antifoam agents was tested using rainbow trout, *Salmo gairdneri*, in 24 h tests. The surface tension of these three compounds was found to depend on concentration and aging time of the test solutions. The toxicity of the surfactant was about twice as high as known values, with a LC_{50} of 8.5 mg/l at 15°C. The addition of antifoam agents to the surfactant solutions further lowered the surface tension but did not alter substantially the fish toxicity of the surfactant. Contrary to expectation, the fish survived in concentrated antifoam solutions at surface tensions as low as 31 dyn/cm for more than 24 h without any apparent damage. The relevance of the surface tension regarding the fish toxicity of detergents in general is critically discussed.

80-002955 Albright, L. J.; P. C. Oloffs and S. Y. Szeto. RESIDUES IN CUTTHROAT TROUT (*SALMO CLARKI*) AND CALIFORNIA NEWTS (*TARICHIA TOROSA*) FROM A LAKE TREATED WITH TECHNICAL CHLORDANE. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes* 15(4):333-349. SFA 25(4)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada] The water of a lake was sprayed with technical chlordane to give a concentration of approximately 10 ppb. Resident California newts (*Tarichia torosa*) and cutthroat trout (*Salmo clarki*) were subsequently collected and analyzed for residue concentrations. The newts were collected at 14, 279, 451, and 1,036 days; the trout at 93, 279, 421, and 1,014 days. At first, the concentrations of residues were very high in both species and their composition, except for heptachlor, resembled that of technical chlordane. The heptachlor was quantitatively epoxidized in newts after 14 days but in trout, some heptachlor was still present after 93 days. Concentrations of total chlordane in body tissues of both species declined more than 98% with time. Of seven individually determined constituents of technical chlordane, *trans*-nonachlor was by far the most persistent, accounting for 49 to 55% of total chlordane in specimens collected last. Both animals produced oxychlordane, probably from γ-chlordane. Heptachlor, heptachlor epoxide and γ-chlordane were non-detectable in both species after 279 days. The results strongly suggest that the California newt metabolizes and eliminates chlordane residues more effectively than the cutthroat trout.

80-002956 Andreyev, A. A.; V. I. Kolupayev and T. A. Karpovich. THE EFFECT OF PHENOL ON OXYGEN STRESS IN THE MUSCLE TISSUE OF THE SIBERIAN ROACH, *RUTILUS RUTILUS LACUSTRIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):164-166. 1979. SFA 25(4)
[Sci. Prod. Combine Paper Ind., Baykal'sk, USSR]

80-002957 Borgmann, U. INTERACTIVE EFFECTS OF METALS IN MIXTURES ON BIOMASS PRODUCTION KINETICS OF FRESHWATER COPEPODS. *Can. J. Fish. Aquatic Sci.* 37(8):1295-1302. Aug. 1980. In English with French summ. SFA 25(4)
[Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002958 Bowers, M. A. III; D. E. Dostal and J. F. Heisinger. FAILURE OF SELENITE TO PROTECT AGAINST MERCURIC CHLORIDE IN EARLY DEVELOPMENTAL STAGES OF THE JAPANESE RICEFISH (*ORYZIAS LATIPES*). *Comp. Biochem. Physiol. C Comp. Pharmacol.* 66(2):175-178. 1980. SFA 25(4)
[J. F. Heisinger: Dep. Biol., Univ. S. Dak., Vermillion 57069] Selenium dioxide pretreatment prior to liver formation in Japanese ricefish (*Oryzias latipes*) failed to protect against mercuric chloride. The mercuric chloride LC_{50}s and 95% confidence limits for selenium pretreated *Oryzias latipes* and for those not pretreated were 5.8 (5.6-6.1) mg/l; and 5.9 (5.5-6.2) mg/l, respectively. Selenium pretreatment following liver formation was protective against mercuric chloride. The mercuric chloride LC_{50}s and 95% confidence limits for selenium pretreated embryos and for those not pretreated were 7.6 (7.0-8.2) mg/l; and 6.5 (6.1-7.0) mg/l respectively. The central roles of the liver, circulatory system and kidney in selenium protection against mercury are discussed.

80-002959 Fisher, J. W.; C. B. Harrah and W. O. Berry. HYDRAZINE: ACUTE TOXICITY TO BLUEGILLS AND SUBLETHAL EFFECTS ON DORSAL LIGHT RESPONSE AND AGGRESSION. *Trans. Am. Fish. Soc.* 109(3):304-309. May 1980. SFA 25(4)
[Environ. Qual. Br., Air Force Aerospace Med. Res. Lab., Wright-Patterson Air Force Base, OH 45433]

80-002960 Goel, K. A. and V. Garg. 2,3',4-TRIAMINOAZOBENZENE-INDUCED HEMATOBIOCHEMICAL ANOMALIES IN FISH (*CHANNA PUNCTATUS*). *Bull. Environ. Contam. Toxicol.* 25(1):136-141. July 1980. SFA 25(4)
[Postgrad. Dep. Zool., D.A.V. Coll., Muzaffarnagar-251001, India]

80-002961 Hazel, R. H. THE DEVELOPMENT OF WATER QUALITY CRITERIA FOR AMMONIA AND TOTAL RESIDUAL CHLORINE FOR THE PROTECTION OF AQUATIC LIFE IN TWO JOHNSON COUNTY, KANSAS STREAMS. *Ph.D. dissertation, Univ. Kans.* 199p. 1979. From Diss. Abstr. Int. B Sci. Eng. 41(1):117. July 1980. SFA 25(4)

80-002962 Ito, Y. and T. Murata. [CHANGES IN GLUCOSE, PROTEIN CONTENTS AND ENZYME ACTIVITIES OF SERUM IN CARP ADMINISTERED ORALLY WITH PCB.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):465-468. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Women's Jr. Coll. Tokai Univ., Miyamae-cho, Shizuoka 420, Japan]

80-002963 Ito, Y.; K. Nishimura and T. Murata. [EFFECTS OF PCB ON LYSOSOMES IN THE HEPATOPANCREAS OF CARP.] *Bull. Jpn. Soc. Sci. Fish.* 46(4):469-472. Apr. 1980. In Japanese with English summ. SFA 25(4)
[Women's Jr. Coll. Tokai Univ., Miyamae-cho, Shizuoka 420, Japan]

80-002964 Iwama, G. K. and G. L. Greer. EFFECT OF A BACTERIAL INFECTION ON THE TOXICITY OF SODIUM PENTACHLOROPHENATE TO JUVENILE COHO SALMON. *Trans. Am. Fish. Soc.* 109(3):290-292. May 1980. SFA 25(4)
[Minist. Environ., Fish. Wildl. Br., 400, 1019 Wharf St., Victoria, BC V8W 2Y9, Canada]

80-002965 Knowles, C. O.; H. J. Benezet and F. L. Mayer, Jr. TRIDIAZURON UPTAKE, DISTRIBUTION AND METABOLISM IN BLUEGILLS AND CHANNEL CATFISH. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes* 15(4):351-364. SFA 25(4)
[Dep. Entomol., Univ. Mo., Columbia 65211]

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002966 Lebsack, M. E.; A. D. Anderson; K. F. Nelson and D. S. Farrier. SUBLETHAL EFFECTS OF AN *IN SITU* OIL SHALE RETORT WATER ON RAINBOW TROUT. *Toxicol. Appl. Pharmacol.* 54(3):462-468. July 1980. SFA 25(3)
[Sch. Pharm., Univ. Wyo., Laramie 82071] An *in situ* oil shale process water, designated Omega-9 water, was used in sublethal concentrations in flow-through bioassays with rainbow trout. Exposure for 96 hr to 0.3% of Omega-9 water (approximately 70% of the LC50) decreased blood packed cell volume (PCV) and hemoglobin concentration. This concentration of Omega-9 water also decreased plasma alkaline phosphatase (AP) activity and protein concentration and caused threefold increases in plasma ammonia levels. Exposure to sublethal concentration of a solution of the 13 major inorganic constituents of Omega-9 water also decreased PCV and plasma AP activity and increased plasma ammonia levels. This study also found that no sublethal effects on blood hemoglobin, protein and alkaline phosphatase occurred at a toxic level less than a fifth of the level of the LC50.

80-002967 McCann, J. A. and R. K. Hitch. SIMAZINE TOXICITY TO FINGERLING STRIPED BASS. *Prog Fish-Cult.* 42(3):180-181. July 1980. SFA 25(4)
[U.S. EPA, Off. Pestic. Prog., Bldg. 288, ARC-East, Beltsville, MD 20705]

80-002968 Moles, A. SENSITIVITY OF PARASITIZED COHO SALMON FRY TO CRUDE OIL, TOLUENE, AND NAPHTHALENE. *Trans. Am. Fish. Soc.* 109(3):293-297. May 1980. SFA 25(4)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

80-002969 Nava, M. E. and F. R. Engelhardt. COMPARTMENTALIZATION OF INGESTED LABELLED PETROLEUM IN TISSUES AND BILE OF THE AMERICAN EEL (*ANGUILLA ROSTRATA*). *Bull. Environ. Contam. Toxicol.* 24(6):879-885. June 1980. SFA 25(4)
[F. R. Engelhardt: Dep. Biol., Univ. Ottawa, Ottawa, ON K1N 6N5, Canada]

80-002970 Niimi, A. J. and C. Y. Cho. UPTAKE OF HEXACHLOROBENZENE (HCB) FROM FEED BY RAINBOW TROUT (*SALMO GAIRDNERI*). *Bull. Environ. Contam. Toxicol.* 24(6):834-839. June 1980. SFA 25(4)
[Can. Cent. Inland Waters, 867 Lakeshore Rd., Burlington, ON L7S 1X9, Canada]

80-002971 Norton, M. G. and F. L. Franklin. RESEARCH INTO TOXICITY EVALUATION AND CONTROL CRITERIA OF OIL DISPERSANTS. *Minist. Agric. Fish. Food Dir. Fish. Res. Fish. Res. Tech. Rep.* No. 57. 20p. 1980. SFA 25(4)
[Fish. Lab., Burnham-on-Crouch, England]

80-002972 Oksama, M. and R. Kristoffersson. THE TOXICITY OF PHENOL TO *PHOXINUS PHOXINUS*, *GAMMARUS DUEBENI*, AND *MESIDOTEA ENTOMON* IN BRACKISH WATER. *Ann. Zool. Fenn.* 16(3):209-216. 1979. SFA 25(4)
[Tvärminne Zool. Stn., Univ. Helsinki, SF-10850 Tvärminne, Finland] The toxicity of phenol to the minnow *P. phoxinus* (L.) and to the crustaceans *M. entomon* (L.) and *G. duebeni* Lillj., all taken from the brackish water of the Baltic Sea, was determined at two temperatures using continuous flow bioassay. The lethal threshold concentrations (LTC) and the conventional 96-h LC50 values were estimated by the log-probit method. For *Mesidotea* the LTC of phenol is 85-100 ppm, for *Gammarus* 32-41 ppm and for *Phoxinus* 10 ppm. For the crustaceans the 96-h LC50 values were two to four times higher than the LTC, whereas for the minnow they were equivalent. In tests on *Mesidotea* 4-chlorophenol was two to three times as toxic as phenol. A temperature rise from 5°C to 10°C had no effect on the toxicity of phenol at LTC. At higher concentrations a temperature increase accelerated

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002972 CONTINUED the toxic effect of both penol (*Gammarus*) and 4-chlorophenol (*Mesidotea*).

80-002973 Rao, D. M. R.; A. P. Devi and A. S. Murty. RELATIVE TOXICITY OF ENDOSULFAN, ITS ISOMERS, AND FORMULATED PRODUCTS TO THE FRESHWATER FISH *LABEO ROHITA*. *J. Toxicol. Environ. Health* 6(4):825-834. July 1980. SFA 25(4)

[A. S. Murty: Nagarjuna Univ., Nagarjunanagar 522 510, South India] The relative toxicity of endosulfan, its isomers, and formulated products to the freshwater fish *Labeo rohita* was tested. The 96-h LC50 values showed that toxicity decreased in the following order: isomer A, 35% emulsifiable concentrate, technical endosulfan, 4% dust, and isomer B. The principal method of detoxification was by formation of endosulfan ether in the liver. Endosulfant, at both sublethal and lethal doses, enhanced oxygen consumption in *L. rohita*. Histological studies showed minor changes in the liver only.

80-002974 Sahib, I. K. A. and K. V. R. Rao. TOXICITY OF MALATHION TO THE FRESHWATER FISH *TILAPIA MOSSAMBICA*. *Bull. Environ. Contam. Toxicol.* 24(6):870-874. June 1980. SFA 25(4)

[Dep. Zool., S. V. Univ., Tirupati-517 502 A. P. India]

80-002975 Samoiloff, M. R.; S. Schulz; Y. Jordan; K. Denich and E. Arnott. A RAPID SIMPLE LONG-TERM TOXICITY ASSAY FOR AQUATIC CONTAMINANTS USING THE NEMATODE *PANAGRELLUS REDIVIVUS*. *Can. J. Fish. Aquatic Sci.* 37(7):1167-1174. July 1980. SFA 25(4)

[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada]

80-002976 Schneider, S. R.; J. D. Hendricks; G. H. Constantine, Jr. and R. E. Larson. TOBRAMYCIN NEPHROTOXICITY AND LETHALITY IN COHO SALMON. *Toxicol. Appl. Pharmacol.* 54(3):399-404. July 1980. SFA 25(3)

[Sch. Pharm., Oreg. State Univ., Corvallis 97331] Treatment of *Yersinia ruckeri*-infected juvenile coho salmon with tobramycin (TBM) revealed significant toxicity of the drug to these fish. In a group of fish receiving only 5 mg/kg/day a cumulative mortality of 100% was observed in 21 days. To verify the site of toxicity, a second study was conducted in order to histologically evaluate specific tissues and to determine dose-response characteristics. TBM produced nephrotoxicity in juvenile coho salmon at dosages only half as great as those required for an equivalent effect in mammals and did so over a much shorter treatment course. Histological examination revealed moderate to complete proximal tubule necrosis at 7.5 mg/kg every other day for 5 days. Lethality occurred at dosages as low as 2 mg/kg/day for 12 days. The data appear to indicate that salmon may be a potential model for studying the nephrotoxic potential of chemicals.

80-002977 Shaffi, S. A. ZINC INTOXICATION IN SOME FRESHWATER FISHES. I. VARIATIONS IN TISSUE ENERGY RESERVE. *Ann. Limnol.* 16(1):91-97. 1980. In English with French summ. SFA 25(4)

[Dep. Sci., R.C.E., N.C.E.R.T., Bhopal 462013, India]

80-002978 Stern, D. H. and M. S. Stern. MODIFIED ROTARY SHAKER PLATFORM. *Prog. Fish-Cult.* 42(3):188-189. July 1980. SFA 25(4)

[Dep. Biol., Univ. Mo., 107 Biol. Sci. Bldg., Kansas City 64110]

TOXICOLOGY; BIOASSAYS (CONTINUED)

80-002979 Thompson, K. W.; A. C. Hendricks and J. Cairns, Jr. ACUTE TOXICITY OF ZINC AND COPPER SINGLY AND IN COMBINATION TO THE BLUEGILL (*LEPOMIS MACROCHIRUS*). *Bull. Environ. Contam. Toxicol.* 25(1):122-129. July 1980. SFA 25(4)
[Cent. Environ. Stud., VPI&SU, Blacksburg, VA 24061]

80-002980 Tomasso, J. R.; M. I. Wright; B. A. Simco and K. B. Davis. INHIBITION OF NITRITE-INDUCED TOXICITY IN CHANNEL CATFISH BY CALCIUM CHLORIDE AND SODIUM CHLORIDE. *Prog. Fish-Cult.* 42(3):144-146. July 1980. SFA 25(4)
[Ecol. Res. Cent., Dep. Biol., Memphis State Univ., Memphis, TN 38152]

80-002981 Tooby, T. E.; J. Lucey and B. Stott. TOLERANCE OF GRASS CARP, *CTENOPHARYNGODON IDELLA* VAL., TO AQUATIC HERBICIDES. *J. Fish Biol.* 16(5):591-597. May 1980. SFA 25(4)
[MAFF Fish. Lab., Remembrance Ave., Burnham-on-Crouch, Essex CM0 8HA, England] Because grass carp may feed selectively on water plants, additional conventional methods may be necessary for effective control of aquatic vegetation. For economic reasons aquatic herbicides are most likely to be used in conjunction with grass carp within an integrated aquatic weed control programme. The acutely lethal toxicities of ten herbicides to grass carp were measured. A preliminary evaluation of the risk to these fish showed that, when used at the recommended rate, the maximum herbicide concentration likely to be found in water should cause little harm to the fish, although attention should be given to the possible inhibition of feeding.

80-002982 Weis, F. and J. S. Weis. EFFECT OF ZINC ON FIN REGENERATION IN THE MUMMICHOG, *FUNDULUS HETEROCLITUS*, AND ITS INTERACTION WITH METHYLMERCURY. *NOAA Fish. Bull.* 78(1):163-166. 1980. SFA 25(4)
[Dep. Anat., N.J. Med. Sch., Newark 07103]

80-002983 Yasuno, M.; S. Hatakeyama and M. Miyashita. EFFECTS ON REPRODUCTION IN THE GUPPY (*POECILIA RETICULATA*) UNDER CHRONIC EXPOSURE TO TEMEPHOS AND FENITROTHION. *Bull. Environ. Contam. Toxicol.* 25(1):29-33. July 1980. SFA 25(4)
[Natl. Inst. Environ. Stud., Yatabe-Tsukuba 305, Japan]

RESEARCH AND MANAGEMENT-GENERAL

80-002984 Adams, P. B. LIFE HISTORY PATTERNS IN MARINE FISHES AND THEIR CONSEQUENCES FOR FISHERIES MANAGEMENT. *NOAA Fish. Bull.* 78(1):1-12. 1980. SFA 25(4)
[NMFS, Southwest Fish. Cent. Tiburon Lab., Tiburon, CA 94920] Natural selection operates at the life history level to maximize the number of surviving offspring. Life history characteristics will vary in consistent patterns to meet this constraint. When theoretical patterns in life histories were investigated in terms of *r* and *K* selection and compared with actual trends in life history characteristics of fishes, the agreement between observed and predicted trends was significant. The effects of harvesting on stocks with these life history trends were investigated and it was found that *K* selected type species would be highly sensitive to overfishing and, once depleted, recovery would require a long time.

80-002985 Graff, D. R. SOME THOUGHTS ON TROUT MANAGEMENT IN THE '80S. *Pa. Angler* 49(9):16-19. Sept. 1980. SFA 25(4)
[Rt. 2, Box 356-F-10, Bellefonte, PA 16823]

RESEARCH AND MANAGEMENT-GENERAL (CONTINUED)

80-002986 Kendall, R. L., (ed.) SELECTED COOLWATER FISHES OF NORTH AMERICA. *Am. Fish. Soc. Spec. Publ.* no. 11. xii + 437p. 1978. Available from Am. Fish. Soc., 5410 Grosvenor Lane, Bethesda, MD 21044.
A collection of papers on Percids and Esocids.--RS

80-002987 May, R. H. THE SEMANTICS OF MODERN TROUT MANAGEMENT: AN ANGLER'S VIEW. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:77-83. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901] SFA 25(4)
Angler activism spawned in the 1960's began to hatch out with increasing intensity in the 1970's. Trout fishermen made new and strident demands on fisheries managers for "quality trout fishing," "wild trout management", "catch-and-release," "no-kill areas," and others. These terms came to mean different things to different people, to the confusion of all. The 1980's may witness a refinement of angler demands for "naturalness" in their trout fisheries. A definition of Natural Trout Management is offered: "Management of trout populations so that any given population, in terms of numbers of fish and sizes of fish, is virtually unaffected by habitat degradation, or angling mortality." Implementation of this mandate would provide sportsmen the opportunity to fish over pristine-like populations of trout despite the presence of increasing numbers of anglers and the modification of habitat for man's other purposes.

REPORTS OF FISHERY STATIONS, STATES, ETC.

80-002988 FAO of the UN. COMMITTEE ON FISHERIES. *FAO Fish. Rep.* No. 228. x + 44p. 1979. SFA 25(4)
[Rome, Italy]

80-002989 Organisation for Economic Co-operation and Development. REVIEW OF FISHERIES IN OECD MEMBER COUNTRIES. 1979. ii + 253p. 1979. SFA 25(4)

HABITAT ALTERATIONS

80-002990 Baldes, R. J. BIG SPRING CREEK CHANNELIZATION SEVENTEEN YEARS LATER. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:96. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901] Abstract only. SFA 25(4)
[U.S. FWS, Lander, WY] A portion of Big Spring Creek was channelised by a bulldoser in 1961. Forty-two hundred feet of meandering stream habitat was changed into a 2200 foot ditch. Prior to the channel change, Big Spring Creek was a natural flowing spring-fed stream, bank-full and provided excellent trout fishing. Almost immediately after the channel alteration, the stream began to change. No longer was it bank-full. Severe erosion of the once undercut banks began to occur, and fishing success took a dramatic drop. Two areas immediately upstream from the channel change were studied to determine loss of adjacent land as a result of the alteration. Comparisons were made from aerial photos in 1938, 1953, 1962, and 1967. Color slides show dramatically results of the channelization. Fish production in various portions of Big Spring Creek are compared. Costs of projects in attempts to mitigate damage to property, prevention of flood damage, etc. are also presented.

HABITAT ALTERATIONS (CONTINUED)

80-002991 Benke, A. C.; D. M. Gillespie; F. K. Parrish; T. C. Van Arsdall, Jr.; R. J. Hunter and R. L. Henry III. BIOLOGICAL BASIS FOR ASSESSING IMPACTS OF CHANNEL MODIFICATION: INVERTEBRATE PRODUCTION, DRIFT, AND FISH FEEDING IN A SOUTHEASTERN BLACKWATER RIVER. *Ga. Inst. Technol. Environ. Resour. Cent.* ERC 06-79. xiii + 187p. Sept. 1979. SFA 25(4)
[Environ. Resour. Cent., Ga. Inst. Technol., Atlanta 30332]

80-002992 Chapman, D. W. and E. Knudsen. CHANNELIZATION AND LIVESTOCK IMPACTS ON SALMONID HABITAT AND BIOMASS IN WESTERN WASHINGTON. *Trans. Am. Fish. Soc.* 109(4):357-363. July 1980. SFA 25(4)
[P.O. Box 1362, McCall, ID 83638]

80-002993 Luey, J. E. and I. R. Adelman. DOWNSTREAM NATURAL AREAS AS REFUGES FOR FISH IN DRAINAGE-DEVELOPMENT WATERSHEDS. *Trans. Am. Fish. Soc.* 109(3):332-335. May 1980. SFA 25(4)
[Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul 55108]

80-002994 Newbold, J. D.; D. C. Erman and K. B. Roby. EFFECTS OF LOGGING ON MACROINVERTEBRATES IN STREAMS WITH AND WITHOUT BUFFER STRIPS. *Can. J. Fish. Aquatic Sci.* 37(7):1076-1085. July 1980. SFA 25(4)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

80-002995 Pister, E. P. MANAGING FISHERIES ON RANGELANDS. *Abst. Position Pap. Soc. Range Manage. Annu. Meet.* 33:12. 1980. Abstract only. SFA 25(4)
[Calif. Dep. Fish. Game, Bishop 93514] Oliver Wendell Holmes once stated: "No generalization is worth a damn, including this one." In many ways this same philosophy holds true as it relates to the controversy surrounding fisheries management versus livestock grazing. In short, we do not yet know enough about the problem except to state in general terms that, under many circumstances, optimum grazing and optimum trout production do not appear to be compatible. My personal experience in this field has been limited to the Inyo National Forest and adjoining areas of similar climate and soil types in the extreme western Great Basin. In some instances I have noted an apparent degradation of stream habitat; in others I have not. There have been puzzling situations wherein the most devastated areas in terms of livestock impact have produced the greatest numbers of trout (but probably not the greatest potential weight). Livestock grazing has recently come to the forefront in the newly created Golden Trout Wilderness, not only from the standpoint of fishery compatibility, but also from the standpoint of whether or not grazing is even aesthetically or biologically acceptable in the Golden Trout Wilderness, bearing in mind the basic intent of the Wilderness Act of 1964 and of Congress in establishing specifically an area implicitly dedicated to a magnificent fish species. One can sense a growing resentment within conservation groups that grazing should be curtailed or even eliminated if there exists any conflict whatsoever in managing the fishery resource. Perhaps it is time, they state, that sound resource management principles rather than tradition, McDonald's and Burger King, should direct the administration of public land resources. We are living in a time when the administrator of public lands is finding it increasingly difficult to fully implement multiple use management, just when the complexity of society is suggesting the more widespread use of this principle. Much of the tunnel vision syndrome affecting both sides of the issue, and attempts are made to broaden everyone's outlook. Examples of good and poor range practice (from the standpoint of the fishery biologist) are given, procedures for implementing remedial changes are suggested, and the question in raised for discussion: "Where do we go from here?" After all, what finer way to end a day of trout fishing than to down a rare top sirloin?

HABITAT ALTERATIONS (CONTINUED)

80-002996 Platts, W. S. LIVESTOCK GRAZING AND RIPARIAN/STREAM ECOSYSTEMS. *Abst. Position Pap. Soc. Range Manage. Annu. Meet.* 33:14. 1980. Abstract only. SFA 25(4)

[U.S. For. Serv. Intermountain For. Range Exp. Stn., Boise, ID 83706] The literature shows that streams modified by livestock grazing are wider and shallower. Generally, they have channels that contain more fine sediment, streambanks that are more unstable, banks that are less undercut, and higher summer water temperatures than natural streams. The literature infers that these changes decrease fish populations, but the data supporting this conclusion are on shaky grounds. More intensive study must be done to place this in proper perspective. The studies do show, however, that better management of livestock grazing is needed. In an extensive literature review, Meehan and Platts (1978) were unable to identify any widely used grazing strategy that is compatible with the environmental needs of streams. McGowan (1976) expresses doubts that present grazing strategies are capable of solving present grazing problems in the aquatic environment. Therefore, ongoing and future studies need to answer the following questions: 1. Which of the existing grazing systems are more compatible with the fishery resource? 2. Is there an ideal livestock grazing strategy for riparian areas? 3. What part can fencing play in protecting critical habitat? 4. How do different classes of livestock affect the riparian environment? 5. During what period of the grazing season is it best to utilize the forage in the riparian zone? 6. What grazing strategies will provide the best protection to brushy vegetation? 7. Can depleted riparian-stream ecosystems be restored through present grazing systems?

80-002997 Prinsenberg, S. J. MAN-MADE CHANGES IN THE FRESHWATER INPUT RATES OF HUDSON AND JAMES BAYS. *Can. J. Fish. Aquatic Sci.* 37(7):1101-1110. July 1980. SFA 25(4)

[Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

80-002998 Stabler, L. A. BEEF STEAK AND WILD TROUT ... MAKING IT HAPPEN. *Abst. Position Pap. Soc. Range Manage. Annu. Meet.* 33:14. 1980. Abstract only. SFA 25(4)

[Calif. Trout, Inc., San Francisco 94126] Livestock and grazing land are a readily replenishable resource ... trout streams are not. Therefore, in the use of public grazing lands there must be a concern not only to provide required upland grazing pastures but at the same time to protect the intrinsic resource value of wild trout streams, coincident to riparian zone pastures. In the management of range lands the whole system has to consider the individuality of its parts. And those parts must be assessed and managed to their best and most productive use. Meadow streams are certainly one of the most fragile parts. Studies indicate unrestricted grazing on meadow streams practically render a stream devoid of its ability to support wild trout ... one of its best uses. Fortunately, additional studies have verified that with grazing exclosure, and rest, a meadow trout stream can repair itself to its more natural state in about 4 to 8 years. Meadow streams in their natural state have what's termed a "concave profile" i.e., deep undercuts above which grow lush riparian vegetation. When unrestricted grazing is allowed on these streams, the vegetation is virtually destroyed ... the banks break down to erode in the stream and additional siltation is caused by the bank sloughing. In one season of grazing, what was once a superior trout stream can become nothing more than a recontoured waterway. Meadow streams must be protected from unrestricted grazing. Fencing seems the most obvious restraint in providing this control. Off-site water development needs should be established. If riparian pasture grazing is critical to a herd's development then a methodology needs to be established to determine, limit, and control the grazing impact on a stream's vitality.

80-002999 U.S. Fish and Wildlife Service. SUMMARIES OF RIPARIAN AND STREAM ALTERATION STUDIES COMPLETED BY THE EASTERN ENERGY AND LAND USE TEAM. *U.S. Fish Wildl. Serv.* vi + 38p. July 1980. Available from Inf. Transfer

HABITAT ALTERATIONS (CONTINUED)

80-002999 CONTINUED Spec., East. Energy Land Use Team, Rt. 3, Box 44, Kearneysville, WV 25430] SFA 25(4)

HARVEST, CREEL CENSUS, ETC.

80-003000 Cauvin, D. THE VALUATION OF RECREATIONAL FISHERIES. *Can. J. Fish. Aquatic Sci.* 37(8):1321-1327. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB, Canada]

80-003001 Havey, K. A. and D. O. Locke. RAPID EXPLOITATION OF HATCHERY-REARED BROOK TROUT BY ICE FISHERMEN IN A MAINE LAKE. *Trans. Am. Fish. Soc.* 109(3):282-286. May 1980. SFA 25(4)
[Me. Dep. Inland Fish. Wildl., Augusta 04333]

80-003002 Lehtonen, H. and K. Salojärvi. KOTITARVE- JA VIRKISTYSKALASTUS SUOMESSA VUONNA 1975. [AMATEUR FISHING IN FINLAND IN 1975.] *Suom. Kalatalous* No. 48. p. 41-55. 1978. In Finnish with English summ. SFA 25(4)
[Riista-ja Kalatalouden Tutkimuslaitos, Kalantutkimusosasto PL 193, 00131 Helsinki 13, Finland]

80-003003 Lehtonen, H. RANNIKON SISÄVESIKALOJEN KALASTUS VUONNA 1976. [FISHING OF FRESHWATER FISHES IN FINNISH BALTIC SEA AREA IN 1976.] *Suom. Kalatalous* No. 48. p. 25-40. 1978. In Finnish with English summ. SFA 25(4)
[Riista-ja Kalatalouden Tutkimuslaitos, Kalantutkimuosasto PL 193, 00131 Helsinki 13, Finland]

80-003004 McAfee, M. E. RANDOM-STRATIFIED CREEL CENSUS FOR COMPARING FISHERMAN USE AND RETURN OF CREEL-SIZE TROUT IN SMALLER COLORADO RESERVOIRS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:1-4. 1980. Available @$5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[Colo. Div. Wildl., 317 W. Prospect, Fort Collins 80526] The random-stratified count interview creel census system was used to determine fisherman use and returns of creel-size trout in 12 different Colorado reservoirs. Three of the reservoirs were in a heavily fished East Slope area, and the rest were located in two different areas of the West Slope. The censuses revealed fishing pressure ranging from 7 hours/acre to 1,600 hours/acre with variation ranging from ± 13% to ± 79%. Estimated returns of planted creel-size fish during their first summer in the lakes ranged from 2% to 114% with variation ranging from ± 9% to ± 108%. The major reasons for the wide variability in these estimates appear to be uneven fishing pressure and small fisherman samples at some of the West Slope waters. Sampling scheme changes which might be tried to improve the precision of these estimates are discussed. Certain problems with estimating returns of creel-size trout are also outlined. Despite the high variation in the estimates, the comparisons provide some valuable baseline information for fisheries work.

80-003005 Smith, C. L. ATTITUDES ABOUT THE VALUE OF STEELHEAD AND SALMON ANGLING. *Trans. Am. Fish. Soc.* 109(3):272-281. May 1980. SFA 25(4)
[Dep. Anthropol., Oreg. State Univ., Corvallis 97331]

REGULATIONS

80-003006 Anderson, R. O. THE ROLE OF REGULATIONS IN ECOLOGICAL MANAGEMENT. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:100. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)

[Mo. Coop. Fish. Res. Unit, Univ. Mo., Columbia] Ecological management is defined as those manipulations which utilize the workings of nature to achieve benefits desired by society. Such management must recognize the constraints imposed by the environment (carrying capacity, productivity) and the individual species (population dynamics, bioenergetics). Fundamental to the concept of ecological management is the concept of balance -- a structure and dynamics of populations, communities and ecosystems which achieve management objectives. In systems with satisfactory habitat and water quality characteristics, the primary problem facing fishery management is overharvest -- the removal of more than the surplus according to management objectives. Indices which utilize length-frequency and length-weight data can help managers recognize the existence of problems such as unsatisfactory rates of reproduction, growth, or mortality. These indices also provide a basis for establishing measurable objectives. Given a supportive public that is interested and concerned about the quality of fishing, appropriate regulations on harvest are a manager's most efficient and effective tactic. Appropriate regulations are those which solve the problems and meet the objectives.

80-003007 Behnke, R. J. SPECIAL REGULATIONS: HISTORICAL PERSPECTIVE. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:58-63. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)

[Dep. Zool., Colo. State Univ., Fort Collins 80523]

80-003008 Bell, S. C. and B. Canoles. IMPLICATIONS OF GAME AND FISH LAWS IN ALABAMA. *Auburn Univ. Agric. Exp. Stn. Circ.* 250. 22p. May 1980. SFA 25(4)

Although ownership of fish and wildlife is vested in the State, Alabama law recognizes that farmer-landowners have the exclusive right to catch and kill the fish and wild animals found on their land. In exercising these exclusive rights to hunt and fish on their property, farmers, like all other Alabamians, must abide by the rules and regulations of the State Department of Conservation. Through numerous statutory and case laws, the Alabama legal structure protects the farmer against intrusion upon his exclusive hunting and fishing rights. By the same token, Alabama law gives the farmer-landowner certain responsibility for the safety of hunters and fishermen on his farms other than trespassers. An additional right granted landowners is the right to propagate wild animals for the purpose of restocking their land with a given wildlife species. Alabama wildlife laws attempt to allow landowners the maximum utility from the wildlife resources found on their property, while at the same time ensuring that future generations of Alabamians will be able to continue benefiting from the State's abundant fish and wild animal populations.--summ.

80-003009 Bjornn, T. C. SPECIAL ANGLING REGULATIONS BENEFIT OVERFISHED TROUT POPULATIONS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:99. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)

[Coop. Fish. Res. Unit, Univ. Idaho, Moscow] Native cutthroat trout populations in the larger streams of central and northern Idaho were overfished, and in some cases virtually eliminated. Special angling regulations were instituted to reduce angling caused mortality as early as 1960 but mainly after 1970. Trout populations responded rapidly to the

REGULATIONS (CONTINUED)

80-003009 CONTINUED reduced mortality with increases in abundance (5-13 times) and average size. Some people no longer fish the streams with special regulations, but the public chose to maintain the wild trout populations rather than replace them with hatchery trout.

80-003010 Grant, G. L. CATCHING, RELEASING, AND TAGGING ATLANTIC SALMON IN ICELAND'S RIVER GRISMA. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:64-69. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901] SFA 25(4)

Generations of Atlantic salmon anglers have grown up with the imprimatur that all fish caught should be killed because they would die shortly after their release. A group of American anglers fishing Iceland's River Grimsa, along with the Icelandic river owners and the guides serving the river, wished to 1) check on the accuracy of this concept: 2) gain information on the habits and activity of the salmon after being caught and released; and 3) provide escapement for natural spawning. This is a report of the release of over 600 fly-caught Atlantic salmon taken in 1978 and 1979, and the tagging of over 400 of these fish. To the writer's knowledge, no similar research has been conducted with sea run Atlantic salmon and the findings reported herein shed some light where there was none previously.

80-003011 Gresswell, R. E. THE EFFECTS OF THE 330 MM MAXIMUM SIZE LIMIT ON THE CUTTHROAT TROUT FISHERY OF YELLOWSTONE LAKE: THE FIRST FIVE YEARS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:70-76. 1980. Available @$5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)

[P.O. Box 2, Yellowstone Natl. Park, WY 82190] Since the inception of Yellowstone Park over 100 years ago, Park visitation has steadily increased to recent levels of over 2.5 million visitors annually. Concomitant increases in angling effort occurred on Yellowstone Lake, the Park's most popular fishery. Although creel limits were periodically reduced between the 1880's and 1968, the condition of trout stocks and general measures of angling success continued to decrease. A 356 mm minimum size restriction imposed in 1970 helped to curb the sharp declines due to intense overfishing during the 1950's and 1960's. Despite initial benefits, however, it became evident that rising harvests and a rapid decrease of older and larger trout negated positive changes. A 330 mm maximum size restriction was implemented in 1975 in order to take advantage of compensatory survival in younger age groups and to recreate multiple age spawning stocks. Thus far, results are encouraging; numbers of older and larger fish have increased rapidly and most measures of angling success have remained stable or increased.

80-003012 Hudelson, R. A. THE CUTTHROAT TROUT POPULATION RESPONSE TO FLY FISHING ONLY REGULATIONS ON A PORTION OF FLAT CREEK WITHIN THE NATIONAL ELK REFUGE. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:100-101. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)

[Wyo. Game Fish. Dep., Jackson] Fly fishing only regulations were imposed on Flat Creek with the 1976 fishing season. The season opening date was established as August 1, to protect spawning activity and waterfowl nesting. Population samples were collected during April and October. The spring sample was designed to monitor trends in the spawning population. Mature males and spent females were dart tagged to monitor seasonal movement and the impact of harvest on mature fish. Trend information indicated fewer spawning fish in the stream each spring since 1976. The size range remained relatively constant indicating essentially the same age structure. Approximately 47% of the sample was made up of mature trout each year, indicating a decline in spawners from about 47 to 14 fish in four years. The fall sample was intended to establish trends of recruitment and measure harvest impact on catchable size fish. The number of fish in the samples has ocillated widely. This is

REGULATIONS (CONTINUED)

80-003012 CONTINUED attributed to flow regime and the associated electrofishing efficiency. The size range of sampled trout remained fairly constant through 1978. Young of the year trout were noticeably more abundant in 1977 and 1979. Harvest and use was measured through three years of creel census data. Then tendency of fly fishermen to practice catch and release was noted. Approximately 70-85% of caught fish were released. The number of creeled fish increased with angler use, but not in direct relationship. Use nearly doubled during the second season of the regulation and remained near that level in succeeding seasons. Harvest was about 0.1 trout per hour. Catch rates varied between 0.38 and 1.52 trout per hour, depending on flow regime. The data collected does not demonstrate a positive population response to special regulation. The decline in the spawning population was attributed to the cessation of stocking at the time tackle restrictions were instituted, thus reducing replacement of mature fish. The mortality of catchable size fish was about 30% between spring and fall samples in 1976 and 1978. In 1979 the fall sample of catchable size fish was about 1.3 times greater than the spring sample. However, tree revetments were placed in the stream to stabilize critical streambank situations, thus providing additional cover. The population increase appeared to be keyed directly to the addition of instream cover.

80-003013 Nehring, R. B. SPECIAL REGULATIONS EVALUATIONS IN COLORADO. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:84-94. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)

[Colo. Div. Wildl., Montrose 81401] Implementation of catch and release angling on two Colorado rivers resulted in a doubling of the catch-per-man-hour (CPMH) over the control sections and over previous years when catch and release angling was not in effect. A fisherman opinion survey indicated that over 93% of all fishermen contacted approved of the catch and release regulation regardless of the section of river fished or the type of lure in use at the time of survey. Where catch and release angling had been in effect for four years, numerical density was 2.9 times greater and standing crop was 4.2 times greater than in the control sections. Average size of the trout in the catch for both rainbow and brown trout was much larger in the catch and release water. More than 17 times as many trout over 381 mm (15 inches) were caught in the catch and release water as in the standard (8 trout/day bag limit) regulations section. The rainbow exploitation rate (total catch/total polutation X 100%) ranged from 149% to 304% in the two catch and release areas indicating the trout can be caught several times a season.

80-003014 Vincent, E. R. EFFECTS OF SPECIAL ANGLING REGULATIONS ON WILD TROUT POPULATIONS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:95. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. Abstract only. SFA 25(4)

[Mont. Dep. Fish. Wildl.-Parks, Bozeman] Two study sections were set up on the Madison River between 6.0 and 10.0 miles below Quake Lake to determine the effect of heavy angling pressure on the wild rainbow trout populations. One section, Pine Butte, was open to catch-and-release fishing with artificial lures and flies only and the other section (Snoball) remained closed to all fishing. After two years of fishing closure, the Snoball section showed an increase of 121% in number and 137% in total pounds for two-year-old and older brown trout. After the first year of catch-and-release regulation, the two-year-old and older rainbow trout in the Pine Butte section increased 126% in number and 101% in total pounds while two-year-old and older brown trout increased 46% in number and 47% in total pounds. A total summer mortality of three-year-old and older trout was higher in the catch-and-release area than the fishing closure area, 47% versus 30%. A creel census-fish population study on the Karst Ranch section on the Gallatin River showed 33% increase in angling pressure from 1972. Total summer mortality of larger rainbow trout was low (less than 35%) except those five-year-old and older (12 inches and longer) which showed 65% summer loss. More trout were

REGULATIONS (CONTINUED)

80-003014 CONTINUED caught and released (57%) than kept (43%). Overall catch rates were higher during 1978 when no stocking of hatchery rainbow trout occurred than 1971 and 1972 when stocking occurred. Fly and bait anglers used the Karst study section in about equal numbers during the 1978 angling season.

MARKING AND TAGGING

80-003015 Baglin, R. E., Jr.; M. I. Farber; W. H. Lenarz and J. M. Mason, Jr. SHEDDING RATES OF PLASTIC AND METAL DART TAGS FROM ATLANTIC BLUEFIN TUNA, *THUNNUS THYNNUS*. *NOAA Fish. Bull.* 78(1):179-185. 1980. SFA 25(4)
[NMFS, c/o Alaska Dep. Fish Game, P.O. Box 686, Kodiak 99615]

80-003016 Bellamy, G. C. THE USE OF BIRD RINGS FOR THE INDIVIDUAL RECOGNITION OF FISH. *Freshwater Biol.* 10(4):371-374. Aug. 1980. SFA 25(4)
[Dep. Zool., Univ. Reading, England] Fish bearing celluloid bird rings on the anterior edge of the dorsal fin can be recognized individually in the field for several weeks. Grayling *Thymallus thymallus*, over 20 cm long, in a fast-flowing river retained recognizable rings for a mean of 47 days. Brown trout *Salmo trutta*, retained rings for comparable periods. Rings could be seen at distances up to 10 m, irrespective of the orientation of the fish to the observer. This marking technique compares favourably with others.

80-003017 Dando, P. R. and R. Ling. FREEZE-BRANDING OF FLATFISH: FLOUNDER, *PLATICHTHYS FLESUS*, AND PLAICE, *PLEURONECTES PLATESSA*. *J. Mar. Biol. Assoc. U.K.* 60(3):741-748. Aug. 1980. SFA 25(4)
[Lab. Mar. Biol. Assoc., Citadel Hill, Plymouth, England] The use of freeze-branding as a field-marking technique for flatfish is described. Similar recapture rates were obtained for flounders marked on the coloured, or eyed, side and for those marked on the white, or blind, side during the first two years after marking. Brands on adult flounders were still identifiable more than four years after release of the fish. The branding technique is also applicable to plaice.

STOCKING AND INTRODUCTIONS

80-003018 Bilton, H. R. and D. W. Jenkinson. RETURNS TO THE FISHERY AND ESCAPEMENT OF ADULT COHO SALMON FROM ACCELERATED AND NORMALLY REARED JUVENILES. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 925. iv + 11p. Feb. 1980. In English with French summ. SFA 25(4)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Under normal hatchery operations, juvenile coho salmon (*Oncorhynchus kisutch*) are reared for at least 14 months before release to the sea as smolts. Reduction of the rearing period would reduce costs substantially. One means of reducing the rearing period would be to accelerate growth of the fish, resulting in the production of smolt-sized juveniles in a shorter period of time, at an earlier age. Such a technique also could have the advantage of increased generation time, whereby adults would mature in their 2nd rather than in their 3rd year of life. In the fall of 1973, an experiment to accelerate growth of coho was initiated at Rosewall Creek on Vancouver Island. During the winter of 1973-74, approximately 10,000 coho were accelerated to the smolt stage in 6 mo through control of temperature, photoperiod and feeding rate. These were marked, nose-tagged and released on June 10, 1974, along with approximately 12,000 normally reared (14 mo), nose-tagged coho. Early maturing male (jack)

STOCKING AND INTRODUCTIONS (CONTINUED)

80-003018 CONTINUED normal-sized (adult) coho originating from these releases were recovered in the escapement and in the fishery. The total return of adults from the accelerated release (3.3%) was much lower than the total return from the normal smolts (47.5%). Males predominanted among adults from the accelerated smolts; the reverse was true among adults from the normally reared smolts. Adults from the accelerated smolt release were smaller than those from the normal smolts. Hence the overall return of adults from normal smolts was 14 times that from accelerated smolts. Results of this one study indicate that rearing of accelerated smolts is not economically feasible.

80-003019 Egglishaw, H. J. and P. E. Shackley. SURVIVAL AND GROWTH OF SALMON, *SALMO SALAR* (L.), PLANTED IN A SCOTTISH STREAM. *J. Fish Biol.* 16(5):565-584. May 1980. SFA 25(4)

[Freshwater Fish. Lab., Pitlochry, Perthshire, Scotland] Salmon eggs and unfed fry were planted in reaches (total length 2.8 km, mean width 4 m) of a Scottish stream between 1971 and 1977 and their subsequent progress was studied by sampling 16 sections (areas 38-126 m^2) of the stream. Brown trout are the only fish which spawn in the stream, waterfalls and a dam near its mouth preventing adult salmon and sea-trout passing upstream. There were no restraints on the downstream movement of fish except in 1977, when a fry trap was operated. In 1971 and 1974 boxes each containing 300 eggs were buried in groups of 3-6. In other years fry were evenly distributed 3.6-29.3 /m^2. At the end of the first growing season, salmon occurred at decreasing population densities for a distance of 600 m below the plantings, but after two growing seasons there was little remaining indication of their pattern of dispersion when planted. Rates of survival between planting and end of the growing season were 9.4-31%. Survival when eggs were planted (11.1-14.8%) was not affected by the numbers planted together at one point (900-1800) or the distance apart of groups of boxes (10-85 m). When fry were planted the instaneous morality rate (M) of the 0+ salmon during their first growing season was related to the inital stocking density (D_p) by the formula $M = 0.00637 + 0.00444 \log_{10} D_p$. Twenty-two to 88% of 0+ salmon present at the end of the growing season were still surviving in the stream as 1+ fish one year later. In 1973-1976 only a small number of 2+ salmon occurred, the majority having migrated between the end of the second growing season and the following spring. There were more 2+ salmon in 1977 and 1978 resulting from higher stocking densities in 1975 and 1976 and slower growth. Trout of several age classes were present but their population densities were never high (<0.6/m^2). Salmon reached a greater size than trout by the end of the first growing season. Their mean weight (W_0, g) at this time was inversely related to their population density (D_0, No./m^2) and the biomass (B_1, g/m^2) of 1+ salmon present, giving the relationship $\log_{10} W_0 = 0.6584 - 0.0558\ D_0 - 0.0352 B_1$. The mean weight of 1+ salmon tended to be highest in sections where the 0+ salmon had reached a relatively large size the previous year. When a reach of the stream was planted twice (11 and 30 May 1977) with salmon fry (total 13.9 /m^2) at the same stage of development, M during the first growing season was 0.0099 per day. This was less than that of fry in a control (M = 0.0107) where the stocking density was lower (6.8 /m^2) and also less than in previous years when single planting rates of approximately 14/m^2 were used (M = 0.0115). The double planting resulted in a wide range of lengths of 0+ salmon in September and the highest biomass values encountered during all experiments.

80-003020 Ohkuma, K.; S. Sasaki and Y. Sato. [STUDIES ON THE PLANTING OF HATCHERY-CULTURED MASU SALMON FRY INTO STREAMS. 8. OBSERVATIONS ON DISPERSAL AND RESIDENCE OF FRY RELEASED IN DIFFERENT MANNERS.] *Sci. Rep. Hokkaido Salmon Hatchery* No. 34. p. 97-103. Mar. 1980. In Japanese with English summ. SFA 25(4)

STOCKING AND INTRODUCTIONS (CONTINUED)

80-003021 Puttmann, S. J. and D. T. Weber. VARIABLE WALLEYE FRY STOCKING RATES IN BOYD RESERVOIR, COLORADO. *Colo. Div. Wildl. Tech. Publ.* No. 33. viii + 47p. July 1980. SFA 25(4)
[Colo. Div. Wildl., 317 W. Prospect, Fort Collins 80526] A research investigation was initiated in 1969 and continued through 1977 to ascertain the effect of various walleye fry stocking rates on the sportfish harvest in 668-ha (1,650-a) Boyd Lake, a typical Colorado Eastern Plains reservoir. Stocking rates of 3,000 and 2,000 fry/surface acre were evaluated in the years 1969-1972 and 1975-1977, respectively. Walleye fry were not stocked in 1973 or 1974 so we could gain an index of natural reproduction. Fish population sampling to determine the composition of resident fish population, and random-stratified creel census to determine fisherman exploitation, were conducted each year of the study. Estimated walleye catch increased from a low of 861 in 1969 to a high of 9,913 in 1972, with a subsequent decline in the catch to an average of 4,330 walleyes per year form 1973 to 1977. The estimated fisherman catch of crappie, the principal sportfish in Boyd Lake prior to the introduction of large numbers of walleye fry, declined from a high of 9,960 in 1969 to 213 in 1977. Estimated annual total numbers of fisherman, hours of fishing effort, and total fish caught declined during the study. Walleye catch-per-man-hour (CPMH) for the period 1969-1977 averaged 0.09 and ranged from a low of 0.01 in 1969 to a high of 0.17 in 1972. The mean CPHM for walley caught from boats and from the bank during the study period was 0.12 and 0.02, respectively. Quality in the walleye fishery, as determined by proportional stock density (PSD), delclined as fisherman catch increased tenfold between 1969 and 1972. The PSD of the crappie fishery was high (94%) in 1969 and remained high as the fisherman catch of crappie in Boyd Reservoir declined throughout the study. It is recommended that if walleye are to be managed as the principal sportfish and predator in selected Colorado reservoirs of lakes, fishery management biologist should plant walleye fry according to a 4-year schedule: Year 1--stock at 2,000 fry/surface acre; year 2--stock at 3,000 fry/surface acre; year 3--do not stock; year 4--do not stock; repeat cycle.

80-003022 Sakuramoto, K. and S. Yamada. A STUDY ON THE PLANTING EFFECT OF SALMON--I. A MATHEMATICAL MODEL FOR THE DERIVATION OF THEIR RATE OF RETURN AND ITS APPLICATIONS. *Bull. Jpn. Soc. Sci. Fish.* 46(6):653-661. June 1980. SFA 25(4)
[Lab. Popul. Dynam., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-003023 Sakuramoto, K. and S. Yamada. A STUDY ON THE PLANTING EFFECT OF SALMON--II. ON THE EFFECT OF PLANTING AND FEEDING. *Bull. Jpn. Soc. Sci. Fish.* 46(6):663-669. June 1980. SFA 25(4)
[Lab. Popul. Dynam., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-003024 White, L. E. EVALUATION OF A NEW PLANTING DEVICE FOR SALMON EGGS. *Prog. Fish-Cult.* 42(3):177-180. July 1980. SFA 25(4)
[Alaska Dep. Fish Game, Fish. Rehabilitation Enhancement Dev. Div., Kodiak 99615]

80-003025 Willis, M. J. OUT-SYSTEM TRANSFERS OF COHO SALMON STOCKS IN COASTAL RIVER SYSTEMS 1960-79. *Oreg. Dep. Fish. Wildl. Inf. Rep. Ser. Fish.* No. 79-9. 12p. Sept. 1979. SFA 25(4)

FISHING GEAR AND TECHNIQUES

80-003026 Brabant, J. C. and C. Nédélec. BOTTOM TRAWLS FOR SMALL-SCALE FISHING. *FAO Fish. Tech. Pap.* No. 189. v + 40p. 1979. SFA 25(4)
[Inst. Sci. Tech. Pech. Mar., 62200 Boulogne-sur-Mer, France]

80-003027 Ishida, T.; M. Tanaka and K. Ohkuma. [ON THE MESH SELECTIVITY OF GILLNET FOR KOKANEE.] *Sci. Rep. Hokkaido Salmon Hatchery* No. 34. p. 121-123. Mar. 1980. In Japanese. SFA 25(4)

80-003028 Joswiak, G. R.; P. J. English; W. S. Moore and A. B. Eisenbrey. INTEGRATED-CIRCUIT PULSE TRIGGER FOR ELECTRIFISHING. *Trans. Am. Fish. Soc.* 109(3):340-342. May 1980. SFA 25(4)
[Dep. Biol. Sci., Wayne State Univ., Detroit, MI 48202]

80-003029 Libey, G. S. and J. R. Beltz. METHOD FOR MONITORING DOWNSTREAM-MIGRATING ALEWIVES. *Prog. Fish-Cult.* 42(3):172-173. July 1980. SFA 25(4)
[Dep. For. Nat. Resour., Purdue Univ., West Lafayette, IN 47907]

80-003030 Matuda, K. and N. Sannomiya. COMPUTER SIMULATION OF FISH BEHAVIOR IN RELATION TO FISHING GEAR--I. MATHEMATICAL MODEL OF FISH BEHAVIOR. *Bull. Jpn. Soc. Sci. Fish.* 46(6):689-697. June 1980. SFA 25(4)
[Tokyo Univ. Fish., Minato-ku, Tokyo 108, Japan] A mathematical model is presented in order to investigate the problems of fish behavior in relation to fishing gear using the technique of computer simulation. The fundamental equations of motion are described by regarding the motion of a fish as that of a particle. The equations of motion contain the fundamental elements of fish behavior such as mass, drag coefficient and external forces acting on the fishes. As external forces, the following six forces are introduced; propulsive force, interactive force, schooling force, repulsive force against wall, directional force and random force. The computer simulation is carried out by solving a system of the nonlinear difference equations by means of TSS (Time Sharing System). The position of each individual is plotted as a result of the computer experiment in order to check the propriety of the model. The moving patterns of fishes obtained by the simulation are quite similar to actual behavior of fish school. It was shown that the model is suitable for investigating fish behavior in relation to fishing gears.

80-003031 Mesick, C. F. and J. C. Tash. EFFECTS OF ELECTRICITY ON SOME BENTHIC STREAM INSECTS. *Trans. Am. Fish. Soc.* 109(4):417-422. July 1980. SFA 25(4)
[Ariz. Coop. Fish. Res. Unit, Univ. Ariz., Tucson 85721]

80-003032 Wohlgemuth, E. ON SELECTIVITY OF GILL NETS FOR, AND CERTAIN BIOLOGICAL PARAMETERS OF, *ALBURNUS ALBURNUS* AND *RUTILUS RUTILUS*. *Folia Zool.* 28(4):371-383. 1979. SFA 25(4)
[Inst. Vert. Zool., Czech. Acad. Sci., Brno, Czechoslovakia]

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

80-003033 Haynes, J. M. and R. H. Gray. INFLUENCE OF LITTLE GOOSE DAM ON UPSTREAM MOVEMENTS OF ADULT CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*. *NOAA Fish. Bull.* 78(1):185-190. 1980. SFA 25(4)
[Dep. Biol. Sci., State University Coll., Brockport, NY 14420]

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC. (CONTINUED)

80-003033 CONTINUED

80-003034 Moen, T. E. and M. R. Dewey. LOSS OF LARVAL FISH BY EPILIMNIAL DISCHARGE FROM DEGRAY LAKE, ARKANSAS. *Proc. Ark. Acad. Sci.* 32:65-67. 1978. SFA 25(4)

[U.S. FWS, Multi-Outlet Reservoir Study, Arkadelphia, AR 71923] Weekly samples of larval fish were collected from water discharged from the epilimnion of DeGray Lake into the tailwaters, for power generation, from April through August, 1976 and 1977. Peak rates of loss measured were 1.4 larvae/m^3 in May, 1976 and 2.7/m^3 in April, 1977. Sunfish, shad and crappie made up 97% of an estimated 83.3 million fish lost in 1976, and 98% of 122.4 million lost in 1977. The most critical period for larval fish loss extended from the last week of April to the first week of June. No definite relationships were noted between length of the power generation period or power generation rate, and rate of larval fish discharge. Diel collections showed the rate of larval fish discharge to be lower and more uniform during darkness than during daylight.

MATHEMATICS, STATISTICAL METHODS, AND MODELING

80-003035 Aalto, S. and G. E. Newsome. SOME METHODS OF ESTIMATING THE PARAMETERS OF THE LESLIE MATRIX USING INCOMPLETE POPULATION DATA. *Can. J. Fish. Aquatic Sci.* 37(7):1140-1148. July 1980. SFA 25(4)

[Dep. Math., St. Francis Xavier Univ., Antigonish, NS B2G 1C0, Canada]

80-003036 DeAnglis, D. L.; P. A. Hackney and J. C. Webb. A PARTIAL DIFFERENTIAL EQUATION MODEL OF CHANGING SIZES AND NUMBERS IN A COHORT OF JUVENILE FISH. *Environ. Biol. Fishes* 59(3):261-266. 29 Sept. 1980. SFA 25(4)

[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830] Numbers and lengths of young crappie were measured over a 20-week period in a Tennessee River reservoir. From these data, the average length at the swimming interval and growth rate were computed. A partial differential equation model was formulated for changes in length distribution through time. The equation was solved analytically and this solution used to predict the numbers by length class through time, given an initial known recruitment or swim-up rate. The simulated numbers agreed in considerable detail with the observations, indicating that the model accurately reflected the basic population mechanics involved. This suggests the model can be used to predict impacts to the fish population of size-dependent mortality caused by man, such as impingement on power plant intake screens.

80-003037 Gardner, R. H.; R. V. O'Neill; S. W. Christensen; W. Van Winkle and J. H. Carney. ERROR ANALYSIS OF DENSITY-INDEPENDENT AND DENSITY-DEPENDENT LESLIE MODELS FOR FISH POPULATIONS. *Bull. Ecol. Soc. Am.* 61(2):62. June 1980. Abstract only. SFA 25(4)

[Oak Ridge Natl. Lab., Oak Ridge, TN] The direct effects and interactions of parameter uncertainties, number of life stages (age classes), density dependent survivorship, and power plant mortality have been considered for several density independent and density dependent Leslie matrix models of fish populations. Monte Carlo methods were used to generate random values for parameters (normal distributions and coefficient of variation, CV, of 10%) and to produce 1000 solutions of each system. Comparisons at year 40 of several density-independent models indicated that all these models amplify errors with time. If P_0, the probability of survivorship from eggs to young-of-the-year, is held constant the mean total population of striped bass (15 age classes) varies by 6%. If P_0 is allowed to vary the predicted

MATHEMATICS, STATISTICAL METHODS, AND MODELING (CONTINUED)

80-003037 CONTINUED mean increases by a factor of 2 and the CV increases to 254%. Predictions based solely on the mean or the deterministic solution may be inadequate and misleading. Comparison of several density-dependent models failed to demonstrate the biased predictions of the density-independent models. With the uncertainties set at 10%, it is not possible to distinguish between these models or to demonstrate distinct differences in behavior.

80-003038 Mendelssohn, R. USING MARKOV DECISION MODELS AND RELATED TECHNIQUES FOR PURPOSES OTHER THAN SIMPLE OPTIMIZATION: ANALYZING THE CONSEQUENCES OF POLICY ALTERNATIVES ON THE MANAGEMENT OF SALMON RUNS. *NOAA Fish. Bull.* 78(1):35-50. 1980. SFA 25(4)
[NMFS, Southwest Fish. Cent., Honolulu, HI 96812] The mathematics of Markov decision processes and related techniques are used to analyze a model relevant to salmon management. It is shown that the choice of grid can have a significant effect on the results obtained. Optimal policies that maximize total expected discounted return may be too variable. Smoothing costs are included to trade off long-run total return against the smoothness of the year-to-year fluctuations in the allowed harvest. Simpler, approximate policies that have a smoothing effect are also found. Preliminary analysis suggests the results are robust against misspecification of the parameters of the model. Concepts such as maximum sustainable yield would seem to impute a very high smoothing cost and are probably not practical for fish populations with a significant degree of randomness.

80-003039 Mohn, R. K. BIAS AND ERROR PROPAGATION IN LOGISTIC PRODUCTION MODELS. *Can. J. Fish. Aquatic Sci.* 37(8):1276-1283. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Fish. Oceans, P.O. Box 550, Halifax, NS B3J 2S7, Canada]

80-003040 Nielsen, L. A. and W. F. Schoch. ERRORS IN ESTIMATING MEAN WEIGHT AND OTHER STATISTICS FROM MEAN LENGTH. *Trans. Am. Fish. Soc.* 109(3):319-322. May 1980. SFA 25(4)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061]

80-003041 Paloheimo, J. E. ESTIMATION OF MORTALITY RATES IN FISH POPULATIONS. *Trans. Am. Fish. Soc.* 109(4):378-386. July 1980. SFA 25(4)
[Dep. Zool., Univ. Toronto, Toronto, ON M5S 1A1, Canada]

80-003042 Peterson, J.; M. Taylor and A. Hanson. LESLIE POPULATION ESTIMATE FOR A LARGE LAKE. *Trans. Am. Fish. Soc.* 109(3):329-331. May 1980. SFA 25(4)
[Nebr. Game Parks Comm., Lincoln 68503]

80-003043 Roff, D. A. and D. J. Fairbairn. AN EVALUATION OF GULLAND'S METHOD FOR FITTING THE SCHAEFER MODEL. *Can. J. Fish. Aquatic Sci.* 37(8):1229-1235. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-003044 Stauffer, J. R.; R. L. Reish and W. F. Calhoun. FORTRAN PROGRAM FOR CALCULATING BRILLOUIN'S SPECIES DIVERSITY INDEX. *Prog. Fish-Cult.* 42(3):185-187. July. 1980. SFA 25(4)
[Appalachian Environ. Lab., Univ. Md., Frostburg State Coll., Frostburg 21532]

MATHEMATICS, STATISTICAL METHODS, AND MODELING (CONTINUED)

80-003045 Uhler, R. S. LEAST SQUARES REGRESSION ESTIMATES OF THE SCHAEFER PRODUCTION MODEL: SOME MONTE CARLO SIMULATION RESULTS. *Can. J. Fish. Aquatic Sci.* 37(8):1284-1294. Aug. 1980. In English with French summ. SFA 25(4)
[Dep. Econ., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

LAKE MANAGEMENT AND RESEARCH

80-003046 Forney, J. L. EVOLUTION OF A MANAGEMENT STRATEGY FOR THE WALLEYE IN ONEIDA LAKE, NEW YORK. *N.Y. Fish Game J.* 27(2):105-141. July 1980. SFA 25(4)
[Dep. Nat. Sci., Cornell Univ., Ithaca, NY] The search for a viable management strategy for the walleye in Oneida Lake began in the 1950's when fluctuations in the catch and other symptoms of stress were first detected. Surveys to estimate the harvest and the abundance of stock established the fact that angling exploitation was intense in some years, but much of the variability in walleye abundance was attributable to 40-fold fluctuations in recruitment. Subsequent research focused on questions of how recruitment was regulated and interactions between the walleye and its primary prey the yellow perch. Managers who expect large gains in yield by fine-tuning sport fisheries will find little encouragement in this paper. Frequent changes in the vulnerability of the walleye to angling reduced the effectiveness of angling regulations, and hopes of increasing recruitment were frustrated by evidence that there were few "surplus" prey to support a larger predator population.

80-003047 Johnson, M. G. GREAT LAKES ENVIRONMENTAL PROTECTION POLICIES FROM A FISHERIES PERSPECTIVE. *Can. J. Fish. Aquatic Sci.* 37(7):1196-1204. July 1980. SFA 25(4)
[Great Lakes Biolimnol. Lab., Burlington, ON, Canada]

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-003048 Balirwa, J. S. and F. W. B. Bugenyi. NOTES ON THE FISHERIES OF THE RIVER NZOIA, KENYA. *Biol. Conserv.* 18(1):53-58. June 1980. SFA 25(4)
[Uganda Freshwater Fish. Res. Organ., P.O. Box 343, Jinja, Uganda] The fisheries of the River Nzoia in Western Kenya depend largely on seasonal flooding regimes which result in the ascent of migrant fishes from Lake Victoria. These notes summarise some of the information available on the fisheries, and discuss recent data on some physico-chemical features of the river, as well as other factors which may possibly endanger the fishery.

80-003049 Bodi, F. L. PROTECTING COLUMBIA RIVER SALMON UNDER THE ENDANGERED SPECIES ACT. *Environ. Law* 10(2):349-387. 1980. SFA 25(4)
[NOAA, Off. Gen. Counc., Seattle, WA]

80-003050 Dudley, R. G. and R. J. Scully. CHANGES IN EXPERIMENTAL GILLNET CATCHES FROM THE KAFUE FLOODPLAIN, ZAMBIA, SINCE CONSTRUCTION OF THE KAFUE GORGE DAM. *J. Fish. Biol.* 16(5):521-537. May 1980. SFA 25(4)
[Sch. For. Resour., Univ. Ga., Athens 30602] The Kafue Floodplain fishery produces an annual fish yield of about 5000 tonnes. The 1971 closure of the Kafue Gorge Dam downstream from the floodplain modified flooding patterns.

RIVER AND STREAM MANAGEMENT AND RESEARCH (CONTINUED)

80-003050 CONTINUED Pre-impoundment studies predicted this modification would increase fish stocks. Experimental gillnets set in 1975 and 1976 caught 18 species on a regular basis, nine of which were abundant enough for comparison with catches in similar gillnet samples taken prior to completion of the Kafue Gorge Dam. Of these nine species, experimental gillnet catches of three predator species were smaller in 1975-76 than in 1969-70. Catches of only one species increased significantly. Whether this change is due to the modified flooding pattern is unclear; unusually dry flood conditions in 1973 and increased fishing effort may have contributed.

80-003051 Landau, J. C. EMPTY VICTORIES: INDIAN TREATY FISHING RIGHTS IN THE PACIFIC NORTHWEST. *Environ. Law* 10(2):413-456. 1980. SFA 25(4)
[Northwestern Sch. Law, Lewis and Clark Coll., Portand, OR]

80-003052 McArthur-Phillips, M. ODD MAN OUT: IDAHO'S BID FOR A FAIR SHARE OF COLUMBIA RIVER UPRIVER ANADROMOUS FISH STOCKS. *Environ. Law* 10(2):389-411. 1980. SFA 25(4)
[Northwestern Sch. Law, Lewis and Clark Coll., Portland, OR]

80-003053 McPherson, B. MORE ON THE ROGUE. *Oreg. Wildl.* 35(9):10-11. Sept. 1980. SFA 25(4)
[4100 SE Delmonte Place, Albany, OR 97321]

80-003054 Platts, W. S. and S. B. Martin. RETURN OF THE SOUTH FORK SALMON. *Idaho Wildl.* 2(4):2-9. July-Aug. 1980. SFA 25(4)
[U.S. For. Serv., Intermountain For. Range Exp. Stn., 507 25th St., Ogden, UT 84401] The South Fork Salmon River steadily degraded from 1952 to 1965 from accrued bedload sediment caused mainly by road construction and logging. During 1952 to 1965 the river was incapable of discharging the bedload sediment as fast as it was being recruited. Spawning and rearing areas were blanketed with sand during this period. During 1966 to 1970 the river gained the capability of discharging, from its system, sediment equal to that being accrued from the watershed, plus portions of the sediment contained within the channel. This report discusses these changes as they influenced the spawning and rearing areas.

80-003055 Reice, S. R. THE EFFECTS OF FISH MANIPULATIONS AND DETRITUS LOAD ON WOODLAND STREAM ECOSYSTEMS. *Bull. Ecol. Soc. Am.* 61(2):98. June 1980. Abstract only. SFA 25(4)
[Univ. N.C., Chapel Hill] The experiment addresses the question of the relative roles of predation and competition in determining community structure and function in small woodland streams. Two second order streams in Piedmont North Carolina were divided into 12 experimental segments with wiers. Each experimental segment was approximately 3 m wide and 10 m long. Half the segments had all fish removed by electroshocking, while the others were unchanged. The fish treatment was cross-classified with a detritus manipulation. Detritus in the form of leaves was added or removed to produce 4 times normal, normal, and 5% normal detritus levels. Each treatment combination was replicated twice. The system-wide reponse over 2 years was monitored by sampling. Reponse varibles for the animal community which were measured included: species distribution and abundance, species richness and diversity, biomass of major taxonomic groups, and other structural features. The system's functional response was measured as change in the monthly leaf litter decompositon rate. Implications for the regulation of community structure in ecosystems are suggested.

80-003056 Robinson, J. L. and M. A. Smith. STREAM MORPHOLOGY IN TWO ADJACENT GRAZING SYSTEMS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:28-31. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St.,

RIVER AND STREAM MANAGEMENT AND RESEARCH (CONTINUED)

80-003056 CONTINUED Rock Springs, WY 82901] SFA 25(4)
This report presents the results of studies conducted on Pole Moutain, in the Medicine Bow National Forest, East of Laramie, Wyoming. This study evaluated stream morphology in continuous and deferred rotation grazing allotments. Results indicate an increase in bank stability following implementation of deferred rotation grazing. Improvements in stream morphology also included greater stream channel with water ratio and different overhead cover. Fish population surveys provided by the Wyoming Game and Fish Department indicate population increases in brook trout (*Salvelinus fontinalis*) in the deferred rotation streams.

80-003057 Smith, B. H. NOT ALL BEAVER ARE BAD; OR, AN ECOSYSTEM APPROACH TO STREAM HABITAT MANAGEMENT, WITH POSSIBLE SOFTWARE APPLICATIONS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:32-37. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[1605 Donalynn Dr., #26, Rock Springs, WY 82901] Pilot studies in the Rock Springs District have indicated that the establishment of stream habitat improvements can be achieved through a "software" approach of providing evironmental limiting factors for beaver, i.e., necessary material and food supplies. When applied within a multiple-use management framework, this approach could prove to be highly compatible with other programs (e.g., aspen thinning to stimulate big game browse regeneration). In addition, when compared to physical instream improvements, the approach could be quite cost effective in ligh of present material, installation, and maintanence costs.

80-003058 Wilson, J. RESEARCH PROJECT PROVIDES A SHOCKING LOOK AT MUSKY STREAMS. *Ky. Happy Hunting Ground* 36(4):10-15. July-Aug. 1980. SFA 25(4)

80-003059 Windell, J. T. COLORADO'S WATER RESOURCES, USES, ABUSES AND CURRENT STATUS. *Proc. Annu. Meet. Colo.-Wyo. Chapter Am. Fish. Soc.* 15:47-57. 1980. Available @ $5.00 from Bruce Smith, 2403 Victor St., Rock Springs, WY 82901. SFA 25(4)
[Dep. EPO Biol., Univ. Colo., Boulder 80309] A holistic view of Colorado's water resources, uses, abuses, and current status is examined by using the Horton-Strahler stream order analysis system. It is proposed that the management of state water resources should be related to the integrated whole which has a reality independent of and greater than the sum of the parts. Analysis of a computer generated resource map indicates that 56% and 44% of the total land surface in Colorado contains approximately 16,700 miles of coldwater and warmwater resource, respectively. Small streams (orders 1-3) comprise 85%, medium streams (orders 4-6) 12%, and large streams (orders 7-12) 3% of the total stream mileage. Documented evidence, from specific uses and abuses such as road building, water supplies, point source and nonpoint source pollution, mine drainage, dam and reservoir construction, transmountain diversions, channelization-dredge and fill operations, irrigated agriculture, instream flows, livestock grazing, fish and wildlife, and small habitat modifications, suggest that the majority of man's activities are concentrated on an extremely limited and finite number of medium (1,044 miles) and large (261 miles) coldwater stream miles.

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

80-003060 Carline, R. F. FEATURES OF SUCCESSFUL SPAWNING SITE DEVELOPMENT FOR BROOK TROUT IN WISCONSIN PONDS. *Trans. Am. Fish. Soc.* 109(4):453-457. July 1980. SFA 25(4)

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

80-003060 CONTINUED
[Ohio Coop. Fish. Res. Unit, Ohio State Univ., 1735 Neil Ave., Columbus 43210]

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH

80-003061 Dudley, R. G.; R. D. Quintrell and G. S. Beisser. HYPOLIMNIAL OXYGEN INJECTION: A BENEFIT TO DOWNSTREAM FISH POPULATIONS? *Environ. Biol. Fishes* 5(3):235-242. 29 Sept. 1980. SFA 25(4)
[Sch. For. Resour., Univ. Ga., Athens 30602] Changes in electrofishing catch rates downstream from Clark Hill Reservoir were only mildly affected by addition of oxygen to the hypolimnion waters prior to discharge in spite of increases in oxygen concentration. Changes in abundance and distribution of six major species were detectable and beneficial effects undoubtedly occur, but the overall benefit of oxygenation, at least at Clark Hill Dam, is questionable. At other dams with a more pronounced and prolonged oxygen-poor period, oxygenation may be worthwhile.

80-003062 Kohler, C. C. TROPHIC ECOLOGY OF AN INTRODUCED, LAND-LOCKED ALEWIFE (*ALOSA PSEUDOHARENGUS*) POPULATION AND ASSESSMENT OF ALEWIFE IMPACT ON RESIDENT SPORTFISH AND CRUSTACEAN ZOOPLANKTON COMMUNITIES IN CLAYTOR LAKE, VIRGINIA. *Ph.D. dissertation, VPI&SU.* 208p. 1980. From Diss. Abstr. Int. B Sci. Eng. 41(3):806. Sept. 1980. SFA 25(4)
Although alewife were shown to possess several negative traits for forage fish, no forage species has proven ideal for southeastern reservoirs. Alewife introduction should be limited to systems too cold for threadfin shad, and that are managed primarily for pelagic predators with non-pelagic young or those that are maintained on a put-grow-take basis. Results of the study underscore the importance of assessing community impacts of all exotic species before wide-spread introduction.--From abstr.

MARINE MANAGEMENT AND RESEARCH

80-003063 Clark, C. W. TOWARDS A PREDICTIVE MODEL FOR THE ECONOMIC REGULATION OF COMMERCIAL FISHERIES. *Can. J. Fish. Aquatic Sci.* 37(7):1111-1129. July 1980. SFA 25(4)
[Dep. Math., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-003064 FAO of the UN. ASSESSMENT AND MANAGEMENT OF THE BLACK SEA TURBOT. *FAO Fish Rep.* No. 226. v + 19p. 1979. SFA 25(4)
[Rome, Italy]

80-003065 FAO of the UN. WORKING PARTY OF EXPERTS ON CENTRAL AND WESTERN PACIFIC SKIPJACK. *FAO Fish Rep.* No. 224. iv + 8p. 1979. SFA 25(4)
[Rome, Italy]

80-003066 FAO of the UN. INDIAN OCEAN FISHERY COMMISSION. COMMITTEE FOR THE DEVELOPMENT AND MANAGEMENT OF THE FISHERY RESOURCES OF THE GULFS. *FAO Fish. Rep.* No. 223. v + 15p. 1979. SFA 25(4)
[Rome, Italy]

MARINE MANAGEMENT AND RESEARCH (CONTINUED)

80-003067 Reshetnikov, Yu. S. WHITEFISHES IN NORTHERN ECOSYSTEMS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 19(3):31-44. 1979. SFA 25(4)
[A. N. Severtsov Inst. Evol. Morphol. Anim. Ecol., USSR Acad. Sci., Moscow, USSR] Whitefishes constitute 70-80% of the fish production in Arctic and subarctic freshwater ecosystems. A considerable part of the energy feeding into such ecosystems is used to maintain the biomass of large fish of an older age, i.e. the biomass predominates considerably over production, and the P/B coefficient is 13-30%, while fish productivity rarely exceeds 2-5 kg/ha. The influence of fishing, eutrophication and the introduction of new species on the compositon and structure of the fish fauna is analyzed, taking Lake Imandra, Syamozero, the Pskov-Chudskoye body of water and Lake Sevan as examples. Successional changes in ecosystems as they become enriched, take the form of replacing whitefishes by Percidae and Cyprinidae, while the species diversity and yield increase with the increase in feeding capacity. Starting from the place and role of whitefishes in northern ecosystems and from the three main forms of commercial utilization of these fish (fishing, acclimatization and hatchery rearing) an overall assessment is given of the potentialities of whitefishes in ecosystems of different types, and promising methods of conducting a whitefish farm are outlined.

80-003068 Thurow, F. THE STATE OF FISH STOCKS IN THE BALTIC. *Ambio* 9(3/4):153-157. 1980. SFA 25(4)
[Kiel Univ., Wischhofstr. 1-3, D-2300 Kiel 14, West Germany]

MISC. TECHNIQUES AND EQUIPMENT

80-003069 Foote, K. G. ANGULAR MEASURES OF DORSAL ASPECT TARGET STRENGTH FUNCTIONS OF FISH. *Fiskeridir. Skr. Ser. Havunders.* 17(2):49-70. 1980. SFA 25(4)
[Dep. Appl. Math., Univ. Bergen, Norway]

80-003070 Pieper, R. E. and B. G. Bargo. ACOUSTIC MEASUREMENTS OF A MIGRATING LAYER OF THE MEXICAN LAMPFISH, *TRIPHOTURUS MEXICANUS*, AT 102 KILOHERTZ. *NOAA Fish. Bull.* 77(4):935-942. 1980. SFA 25(4)
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Africa: Lake Tanganyika
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Africa: Lake Victoria
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Alabama
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Alabama: Dauphin Island
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Alabama: Pickwick Reservoir
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Alabama: West Point Reservoir
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Alaska: Wood River Lakes
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Arizona: Becker Lake
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Arizona: Rio Yaqui
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Arizona: Santa Cruz Cty: Monkey Spring
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Arkansas: Cache River
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Arkansas: Caddo River
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Arkansas: DeGray Lake
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Arkansas: Illinois River
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Arkansas: Izard Cty.: Piney Creek
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Arkansas: Lake Dardanelle
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Arkansas: Moro Creek
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Arkansas: Ouachita River
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Arkansas: Ten Mile Creek
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Atlantic Ocean, North: Scotian Shelf
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Atlantic Ocean, North: South Atlantic Bight
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Australia: Great Barrier Reef
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Australia: Victoria
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California: Clear Lake
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California: Colusa Cty.
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California: Humboldt Cty.: Freshwater Lagoon
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California: Humboldt Cty.: Redwood Creek
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California: Jackson Meadows Reservoir
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California: Lake Casitas
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California: Lake Greenhaven
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California: Lake Perris
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California: Los Angeles
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California: Los Angeles Cty.
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California: Merle Collins Reservoir
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California: Modoc Cty.: Cowhead Lake
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California: Mono Cty.: Bunny Lake
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California: Mono Cty: Little Walker River
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California: Monterey Bay
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California: Newport Bay
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California: North Fork Feather River
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California: Pacific Current
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California: Pit River
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California: Riverside Cty.: Lake Perris
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California: Sacramento River
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California: Sacramento-San Joaquin Estuary
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California: Salton Sea
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California: Santa Barbara
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California: Shasta Lake
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Cameroon: River Mungo
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Canada: British Columbia: Centennial Creek
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Canada: British Columbia: Nanaimo River Estuary
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Canada: British Columbia: Tsolum River
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Canada: British Columbia: Vancouver Island
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Canada: Experimental Lakes Area
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Canada: Hudson Bay
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Canada: James Bay
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Canada: Labrador: Churchill Falls
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Canada: Labrador: Ossokmanuan Reservoir
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Canada: Manitoba
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Canada: Manitoba: Assiniboine River
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Canada: Manitoba: Indian Lake
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Canada: Manitoba: Whitemoutn River
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Canada: New Brunswick
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Canada: Nova Scotia: Margaree River
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Canada: Ontario
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Canada: Ontario: Experimental Lakes Area
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Canada: Ontario: Kawartha Lakes
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Canada: Ontario: Lake Opinicon
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Canada: Ontario: Ottawa River
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Canada: Pacific Ocean
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Canada: Prince Edward Island: North Brook
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Canada: Quebec: Caniapiscau River
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Canada: Quebec: Lake Memphremagog
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Canada: Quebec: Magdalen Islands
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Caspian Sea
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Colorado: Boulder Cty.: Left-Hand Cree
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Colorado: Colorado River
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Colorado: Frying Pan River
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Colorado: Green River
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Colorado: Larimer Cty.: Boyd Reservoi
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Colorado: Larimer Cty.: Parvin Lake
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Colorado: South Platte River
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Colorado: St. Vrain River
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Colorado: Yampa River
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Columbia River
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Connecticut: Fairfield Cty.
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Connecticut: Farmington River
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Curacao
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Czechoslovakia
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Czechoslovakia: Rokytna River
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Delaware
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Delaware River
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Ecuador
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England
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Florida: Peace River
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Florida: Tampa Bay
80-001298
80-001374
80-001420
Florida: Tampa Bay: McKay Bay
80-001589
France: Nivelle River
80-001797
France: Rhone River
80-002820
French Polynesia
80-001378
Georgia
80-000769
80-001743
80-002902
Georgia: Bibb Cty.: Lake Tobesofkee
80-001237

Georgia: Carroll Cty.: Dog River
80-002218
Georgia: Clark Hill Reservoir
80-003061
Georgia: Lake Carroll
80-002300
Georgia: Roaring Branch Creek
80-002402
Georgia: Satilla River
80-002991
Georgia: Savannah River
80-002394
80-002399
Georgia: Savannah River Estuary
80-001725
Georgia: West Point Reservoir
80-001363
80-002781
Great Lakes
80-000579
80-000726
80-000747
80-000748
80-001213
80-001788
80-002523
80-002634
80-003047
Greenland
80-000580
Guam
80-000438
Guatemala
80-002863
Gulf of Aden
80-000351
80-002738
Gulf of Aqaba
80-002223
Gulf of California
80-001477
80-002850
Gulf of Mexico
80-000372
80-000692
80-000701
80-000762
80-000921
80-001284
80-001387
80-001513
80-001600
80-001726
80-001816
80-002880
80-002883
80-002950
Gulf of Oman
80-001334
Hawaii
80-000702
80-001301
Hudson Bay
80-002997
Iceland
80-003010
Iceland: Lake Myvatn
80-000065
80-000415
Iceland: River Laxa
80-000065
Idaho
80-000083
80-000711
80-003009
Idaho: Columbia River
80-003052
Idaho: Lewis Cty.: Winchester Lake
80-002447
Idaho: Palouse River
80-001401
Idaho: Panther Creek
80-001638
Idaho: Silver Creek
80-000477
Idaho: South Fork Salmon River
80-003054
Illinois
80-002295
80-002334
Illinois: Fox River
80-002338
Illinois: Iroquois River
80-002796
Illinois: Johnson Cty.: Max Creek
80-000354
Illinois: Kane Cty.: Elgin: Trout Park Nat. Preserve
80-002230
India
80-000017
80-000020
80-000027
80-000550
80-000788
80-000809
80-000849
80-001352
80-001357
80-001410
80-001421
80-001585
80-001811
80-002316
India: Chilka Lake
80-001230
80-001245
India: Gulf of Mannar
80-000894
India: Moplah Bay
80-001466
India: River Ganges
80-000393
India: Yamuna River
80-001806
Indian Ocean
80-000404
80-000479
80-000524
80-000565
80-000571
80-000575
80-000894

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Indian Ocean
80-001246
80-001267
80-001273
80-001352
80-001357
80-001421
80-001425
80-001428
80-001452
80-001466
80-001628
80-001639
80-002100
80-002225
80-003066
Indiana
80-002329
Indiana: Carroll Cty.: Deer Ck.
80-002759
Indiana: Palestine Lake
80-002323
Indiana: Spring Mill State Park
80-002308
Indiana: White River
80-002858
Indonesia
80-001411
Indonesia: Rawa Pening
80-001787
Iowa
80-001422
80-002278
Iowa: Des Moines River
80-001625
80-002325
Iowa: Mahaska Cty.
80-000597
Iowa: Maquoketa River
80-001414
Iowa: Marion Cty.
80-000597
Iowa: Story Cty.: Ames
80-001550
Iran
80-002198
Ireland
80-000449
Israel
80-000791
80-000807
80-000811
80-001564
80-002930
Israel: Lake Kinneret
80-000853
Italy
80-000535
80-001838
80-002187
80-002306
80-002941
Italy: Lago di Candia
80-002952
Italy: Lago Maggiore
80-000472
Japan
80-000328
80-000332
80-001143
80-001172
80-001202
80-001217
80-001294
80-001296
80-001584
80-002147
80-002182
80-002257
80-002550
80-002741
80-002753
80-002754
Japan: Atsuta River
80-002842
Japan: Funka Bay
80-002814
Japan: Hokkaido: Atsuta River
80-002855
Japan: Lake Notoro
80-000889
Japan: Sendai Bay
80-002743
Japan: Seto Inland Sea
80-002944
Japan: Tokyo Bay
80-001633
Japan: Yahagi River
80-000892
Kansas
80-001351
80-001647
Kansas: Doniphan Cty.: Wolf River
80-001373
Kansas: Johnson Cty.
80-002961
Kentucky
80-000808
80-002846
80-003058
Kentucky: Barkley Lake
80-001302
Kentucky: Herrington Lake
80-001758
Kentucky: Kentucky Lake
80-001302
Kentucky: Ohio River
80-001257
80-001303
Kentucky: Rough River Reservoir
80-001223
Kentucky: Trimble Cty.: Ohio River
80-000439
Kenya
80-000416
Kenya: Lake Kamburu
80-002113
Kenya: Lake Victoria
80-000743
80-000745
80-002745

Kenya: Nzoia River
80-003048
Lake Erie
80-000857
80-001181
80-001407
80-001430
Lake Huron
80-000719
80-002922
Lake Michigan
80-000398
80-001206
80-001339
80-001549
80-001572
80-001675
80-002052
80-002164
80-002797
Lake Ontario
80-000427
80-000599
80-000740
80-001862
80-002165
80-002192
80-002199
80-002525
Lake Superior
80-000074
80-001439
80-001790
80-002784
Lake Victoria
80-000743
Ligurian Sea
80-000587
Louisiana
80-001291
80-001361
80-001365
80-001382
80-001383
80-001415
80-001416
80-001726
Louisiana: Caminada Bay
80-001408
Louisiana: Chenier Plain Coastal Area
80-001379
80-001380
80-001381
Maine
80-000325
80-002884
Maine: Eagle Lake
80-003001
Maine: Penobscot River
80-002139
Malawi: Lake Malawi
80-002256
Malaysia
80-000529
Maryland
80-001631
Massachusetts
80-001386
80-001744
80-001808
80-002949
Massachusetts: Beverly-Salem Harbor
80-001394
Massachusetts: Boston Harbor
80-001815
Massachusetts: Connecticut River
80-001286
80-001307
80-001921
80-002749
Massachusetts: Pleasant Bay
80-001376
Mediterranean Sea
80-000578
80-000587
80-000686
80-000760
80-001073
80-001913
80-002930
80-002940
Mexico
80-002889
80-002924
80-002925
Mexico: Chihuahua
80-002890
Mexico: Gulf of California
80-002817
80-002850
Mexico: Nuevo León: El Potosi
80-002238
Mexico: Rio Mayo
80-002219
Mexico: Rio Yaqui
80-002208
80-002219
Mexico: Sonora
80-001406
Mexico: Vera Cruz
80-002249
Mexico: Yucatan
80-001431
Michigan
80-000424
80-000426
80-001184
80-001632
80-001636
80-001791
80-001792
Michigan: Au Sable River
80-000749
Michigan: Barry Cty.: Long Lake
80-002412
Michigan: Huron River
80-000704

Michigan: Lawrence Lake
80-001340
Michigan: Manistee Lake
80-001770
Michigan: Ogemaw Cty.: Jewett Lake
80-001764
Michigan: Spring Brook
80-001214
Minnesota
80-001731
80-002993
Minnesota: Minnesota River
80-000358
Minnesota: Scott Cty.: Carls Lake
80-001786
Minnesota: Voyageurs Natl. Park
80-002404
Mississippi
80-000547
80-000832
Mississippi River
80-002442
80-002746
Mississippi River Basin
80-002847
Mississippi: Grenada Reservoir
80-000861
Mississippi: Horn Island
80-000489
Mississippi: Pickwick Reservoir
80-002716
Missouri
80-000486
80-001798
80-002133
Missouri River
80-001803
80-002315
Missouri: Greene Cty.: James River
80-002739
Missouri: Lake Taneycomo
80-001752
Missouri: Mississippi River
80-002442
Missouri: Missouri River
80-001803
Missouri: Thomas Hill Reservoir
80-001742
Montana
80-000574
80-001391
80-001470
80-001794
80-002332
80-002769
Montana, Southeastern
80-002203
Montana: Big Spring Creek
80-002990
Montana: Flathead Lake
80-000072
Montana: Gallatin River
80-003014
Montana: Kootenai River
80-002195
Montana: Madison River
80-003014
Montana: Tongue River
80-002331
Montana: Yellowstone River
80-001799
Nebraska
80-001444
80-001749
80-002209
Nebraska: Garden Cty.: Island Lake
80-003042
Nebraska: Lake McConaughy
80-002448
Nebraska: Lancaster Cty.: Branched Oak Lake
80-000434
Nebraska: Missouri River
80-002315
Nebraska: Salt Creek
80-002857
Nebraska: Thirty-two Mile Creek
80-002866
Netherlands
80-000382
Nevada
80-001824
Nevada: Colorado River
80-002810
Nevada: Jersey Valley
80-000517
Nevada: Pyramid Lake
80-000514
80-001297
New Caledonia
80-000511
New England
80-000376
New Hampshire
80-002311
80-002312
80-002934
New Hampshire: Great Bay Estuary
80-002900
New Jersey
80-001741
New Jersey: Delaware River
80-002327
New Jersey: Newark Bay
80-001423
New Mexico
80-000353
80-000506
80-001282
80-002098
New Mexico: Cibola Natl. For.
80-002445
New Mexico: San Juan River
80-001405
New York
80-000579
80-000670
80-001369
80-001385
80-001535

New York: Allegheny River
80-002742
New York: Atlantic Ocean
80-002210
New York: Cazenovia Lake
80-001168
New York: Erie Cty.: Derby Brook
80-000488
New York: Hudson River
80-000492
80-000493
80-002261
80-002805
New York: Hudson River Estuary
80-001606
New York: Lake Champlain
80-002138
New York: Lake George
80-001663
New York: Lewis Cty.: South Sandy Creek
80-000696
New York: Long Island
80-002403
80-002407
New York: Long Island Sound
80-000375
New York: New York Bay
80-001377
New York: Niagara River
80-000363
New York: Oneida Lake
80-001331
80-003046
New York: Warren Cty.: Brant Lake
80-000112
New York: Wolf Lake
80-000350
New Zealand
80-000107
80-000460
80-000461
80-000520
80-000568
80-000690
80-000859
80-000983
80-001139
80-001215
80-001263
80-001271
80-001308
80-001393
80-001459
80-001461
80-002059
New Zealand: Hauraki Gulf
80-000758
New Zealand: Karikari Peninsula
80-001432
New Zealand: Lyttelton Harbour
80-000396
New Zealand: Waikato River
80-000413
Nicaragua: Lake Jiloá
80-002084
Nigeria
80-000442
Nigeria: Lake Kaingi
80-002657
Nigeria: Lake Kainji
80-000465
80-001244
North America
80-000557
80-001573
North America: Pacific Coast
80-000716
North Carolina
80-000440
80-000473
80-001226
80-001289
80-001350
80-001397
80-001398
80-001413
80-001417
80-002764
80-002771
80-003055
North Carolina: Belews Lake
80-001616
80-001623
North Carolina: Cape Fear Estuary
80-000757
North Carolina: Cape Fear River
80-002425
North Carolina: Croatan Natl. For.
80-000495
North Carolina: Currituck Sound
80-000782
80-001435
North Carolina: Great Smoky Mtn. Natl. Park
80-000688
North Carolina: New River
80-002298
North Carolina: Onslow Bay
80-001396
North Carolina: Tar Landing Bay
80-001983
North Dakota
80-000494
80-002324
North Sea
80-000411
80-000469
80-001335
80-001390
80-001813
80-002435
Northern Ireland
80-000685
80-001563
Northern Ireland: Foyle
80-001721
Norway
80-000484
80-002125
80-002936

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Norway: Lake Tveitevatn
80-001481
Ohio
80-002202
Ohio River
80-000439
80-001257
80-001303
Ohio: Chagrin River
80-001430
Oklahoma
80-000402
80-000491
80-000503
80-001233
Oklahoma: Boomer Lake
80-000598
Oklahoma: Illinois River
80-000474
Oklahoma: Keystone Reservoir
80-001304
Oklahoma: Lake Eufala
80-001809
Oklahoma: Lake Texoma
80-000365
80-001277
Oklahoma: Marshall Cty.: Brier Creek
80-000400
Oklahoma: South Canadian River
80-001188
Oklahoma: West Cache Creek
80-000475
Oregon
80-000322
80-000566
80-001392
80-001426
80-001718
80-001763
80-001795
80-001877
80-002554
80-002859
80-002894
80-003005
Oregon: Antelope Reservoir
80-001637
Oregon: Coos Bay
80-001723
Oregon: Mill Creek
80-002406
Oregon: Pacific Ocean
80-000546
Oregon: Rogue River
80-003053
Oregon: Willamette River
80-002793
80-003073
Oregon: Yaquina Estuary
80-002737
Pacific Ocean
80-000166
80-000409
80-000412
80-000423
80-000432
80-000438
80-000464
80-000490
80-000498
80-000565
80-000582
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80-001814
80-002059
80-002100
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80-002216
80-002221
80-002246
80-002253
80-002257
80-002259
80-002452
80-002554
80-002787
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80-002831
80-002848
80-002853
80-002879
80-002885
80-002895
80-002924
80-002925
80-002926
80-003065
Pacific Ocean: Atacama Trench
80-002785
Pacific Ocean: Australia
80-001622
Pacific Ocean: Chile
80-001556
80-002951
Pacific Ocean: Commander Islands
80-000103
Pacific Ocean: Gulf of Alaska
80-000763
80-002698
Pacific Ocean: Japan
80-002147
80-002717
80-002808

Pacific Ocean: New Zealand
80-000568
Pacific Ocean: Oregon
80-000546
Pakistan
80-000559
Pakistan: Kabu Lake
80-002292
Pakistan: Karachi
80-002434
Pakistan: Karachi Coast
80-002293
Panama: Caribbean Sea
80-002200
Papua New Guinea
80-000572
80-002337
80-002879
Pennsylvania
80-000080
80-000081
80-001670
80-002086
80-002387
80-002985
Pennsylvania: Conowingo Pond
80-002328
80-002946
Pennsylvania: Muddy Run
80-000435
Pennsylvania: Muddy Run Pumped Storage Pond
80-002836
Pennsylvania: Susquehanna River
80-002319
Pennsylvania: Susquehanna River System
80-000082
Pennsylvania: Susquehanna River: Conowingo Pond
80-001276
80-002322
Pennsylvania: Washington Cty.: Buffalo Ck.
80-001314
Pennsylvania: Yellow Breeches Creek
80-002232
Pennsylvania: Youghiogheny River
80-000481
Persian Gulf
80-000601
Peru
80-001288
80-001471
Philippines
80-000029
80-000560
80-000802
80-001827
80-001876
Poland
80-002441
Portugal
80-001349
Puerto Rico
80-002262
Red Sea
80-000480
80-001367
80-002128
80-002207
80-002244
80-002258
80-002819
80-002930
Rhodesia: Lake McIlwaine
80-001208
Saudi Arabia
80-002194
Scandinavia
80-001441
Scotia Sea
80-002897
Scotland
80-000360
80-000411
80-000448
80-001216
80-003019
Scotland: Outer Hebrides
80-001370
Sea of Japan
80-002853
Senegal: Senegal River
80-001796
Sir Lanka
80-002760
Snake River
80-000727
South Africa
80-000523
80-001452
80-002197
South Africa: Lake Baugazi
80-001646
South Africa: Lake Sibaya
80-002832
South Africa: Lake St. Lucia
80-000417
South America
80-002451
80-002751
South Carolina
80-000584
80-000766
80-000769
80-002764
South Carolina: Keowee Reservoir
80-001300
80-002943
South Carolina: Murrells Inlet
80-000691
South Carolina: North Inlet
80-002143
South Carolina: Sewee Bay
80-000694
South Carolina: South Atlantic Big
80-001429
South China Sea
80-000519
80-001269
80-001443

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South Dakota: Missouri River
80-002315
Sri Lanka
80-000355
80-002157
Suez Canal
80-002844
Sweden
80-000746
80-001274
80-001610
80-002082
Tanzania: Lake Tanganyika
80-000097
Tennessee
80-001810
Tennessee: Center Hill Reservoir
80-001260
Tennessee: Great Smoky Mtn. Natl. Park
80-000688
Tennessee: North Fork Holston River
80-002942
Tennessee: Old Hickory Reservoir
80-001229
Tennessee: Pickwick Reservoir
80-002716
80-003036
Texas
80-000030
80-000500
80-000689
80-001600
80-002136
80-002211
Texas: Chenier Plain Coastal Area
80-001379
80-001380
80-001381
Texas: Comal Cty.: Guadalupe River
80-000299
Texas: Devil's River
80-001375
Texas: Galveston Bay
80-000372
80-001336
Texas: Lake Bastrop
80-001615
Texas: Lake E. V. Spence
80-001330
Texas: Lake Texoma
80-000365
80-001277
Texas: Pecos Cty.: Leon Creek
80-002235
Texas: Trinity Bay
80-000372
Thailand: Gulf of Thailand
80-000583
Tunisia
80-001204
Turkey
80-002940
Turkey: Lake Acigól
80-000885
United Kingdom
80-001292
80-002303
United States
80-000004
80-000768
80-000783
80-000784
80-002229
United States, Atlantic Coast
80-002205
United States, Northeastern
80-002450
United States, Northwestern
80-000727
United States, Southeastern
80-000786
80-001127
80-001384
80-001729
80-002938
United States, Western
80-002201
USSR
80-000381
80-000391
80-000408
80-000450
80-000787
80-000925
80-001144
80-001251
80-001262
80-001281
80-001751
80-002545
80-002762
80-002929
80-003067
USSR: Aldan River
80-002228
USSR: Amur Estuary
80-001021
USSR: Anadyr River
80-002864
USSR: Aral Sea
80-000441
USSR: Argun River
80-001395
USSR: Bukhtarma Reservoir
80-002103
USSR: Chulym River
80-000378
USSR: Courland Lagoon
80-000361
80-002101
USSR: Dagestan
80-002778
USSR: Don River
80-002792
USSR: Kakhovka Reservoir
80-002779
USSR: Kamchatka
80-000406
USSR: Kamchatka River
80-000870
80-001252

USSR: Kuybyshev Reservoir
80-001234
USSR: Lake Dal'neye
80-002237
USSR: Lake Khanka
80-001326
USSR: Lake Ladoga
80-000298
USSR: Lake Onega
80-000468
USSR: Mozhaysk Reservoir
80-001023
80-001078
80-001341
80-002633
USSR: Okhotsk Sea
80-000496
USSR: Pacific Ocean
80-002853
USSR: Pritornaya River
80-002149
USSR: Rybinsk Reservoir
80-002153
80-002684
USSR: Saratov Reservoir
80-002828
USSR: Sea of Azov
80-001463
80-002116
USSR: Taganrog Gulf
80-001327
USSR: Tsimlyansk Reservoir
80-002809
USSR: Upper Tuloma Reservoir
80-000905
USSR: Uzbekistan
80-000920
USSR: Vilyuy Reservoir
80-002780
USSR: Volga River
80-002443
USSR: Volgograd Reservoir
80-001342
USSR: White Sea
80-000387
80-001881
USSR: Yenisey River
80-002134
Utah: Colorado River
80-002217
Utah: Green River
80-002449
Utah: Lake Powell
80-000697
Utah: San Rafael River
80-001403
Venezuela
80-002109
80-002899
Venezuela: Lake Valencia
80-001346
80-002491
Vermont
80-001747
Vermont: Lake Memphremagog
80-000068
Virginia
80-000751
80-002398
Virginia: Claytor Lake
80-003062
80-002811
Virginia: James River
80-001399
Virginia: New River
80-001419
Virginia: North Fork Holston Riv
80-002942
Virginia: Rappahannock River
80-000312
Virginia: South Fork Shenandoah
80-001627
Wales
80-000525
80-001512
80-001534
Wales: River Wye
80-000383
Washington
80-001434
80-002137
80-002196
80-002992
Washington: Columbia River
80-001212
80-001514
Washington: Lake Washington
80-000386
Washington: Little Goose Dam
80-003033
Washington: Palouse River
80-001401
Washington: Puget Sound
80-001239
80-001738
80-001874
80-002099
Washington: Skagit River
80-002393
Washington: Wapato Lake
80-000502
West Germany
80-001590
West Virginia
80-002160
West Virginia: Greenbrier Cty.:
Sherwood
80-001259
West Virginia: Randolph Cty.: Sp
Lake
80-002396
Wisconsin
80-001209
80-001210
80-001531
80-002395
80-002423
80-002867
80-002872
80-002874

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Wisconsin
80-003060
Wisconsin: Forest Cty.: Bug Lake
80-002384
Wisconsin: Sawyer Cty.
80-000356
Wisconsin: Vilas Cty.
80-001280
Wyoming
80-000305
80-000780
80-001209
80-001210
80-002514
80-003056

Wyoming: Flat Creek
80-003012
Wyoming: Fontenelle Reservoir
80-001258
Wyoming: Green River
80-001258
Wyoming: North Platte River System
80-002515
Wyoming: Powder River
80-002748
Wyoming: Yellowstone Lake
80-003011
Wyoming: Yellowstone Natl. Park
80-000499
Wyoming: Yellowstone Natl. Park: Firehole River
80-001863
80-002752
Yugoslavia
80-002945
Zaire
80-000471
Zambia: Kafue Gorge Dam
80-003050

Abramis brama
Abundance, Factors of
80-002684
Bacterial Diseases
80-002269
Distribution/Factors of
80-000501
Early Development
80-001912
80-002560
Fecundity
80-002684
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Glugea hertwigi
80-000532
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80-001558
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80-001597
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Gyrodactylus stephanus
80-000559
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80-002277

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80-000549
Haemogregarina sachai
80-001524
80-002275
Haemogregarina simondi
80-000552
80-000553
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80-002301
80-002302
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80-002291
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80-000549
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80-000562
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80-001518
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80-001492
80-002268
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80-002904
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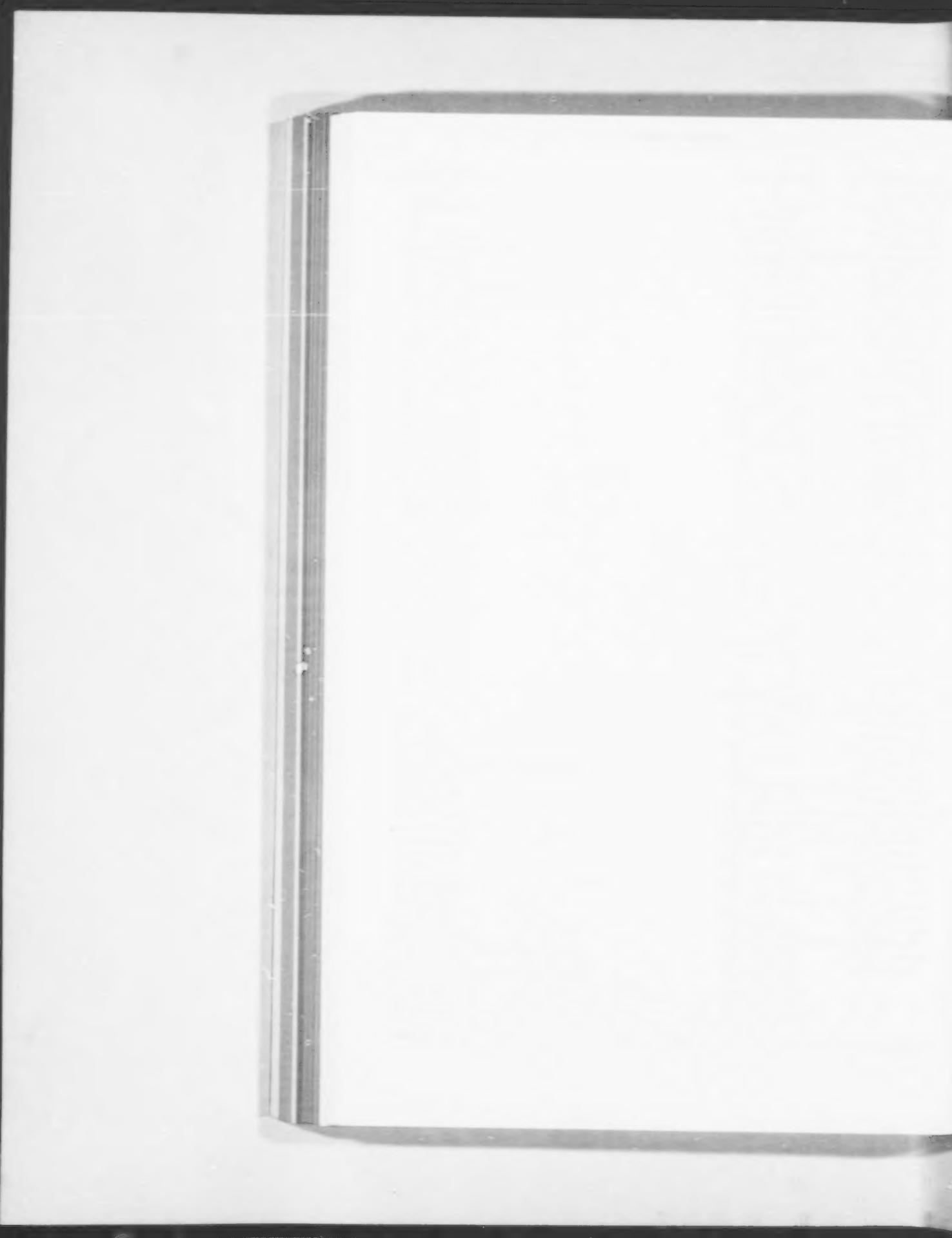

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The following publications were screened for Volume 25 . Publications not included on this list are irregularly published papers or separates from publications not regularly received by the Morgan Library of Colorado State University or this editorial office.

Acta Agriculturae Scandinavica
Acta Biotheoretica
Acta Hydrochimica et Hydrobiologica
Acta Parasitologica Polonica
Acta Pathologica et Microbiologica Scandinavica Section A Pathology
Acta Pathologica et Microbiologica Scandinavica Section B Microbiology
Acta Pharmacologica et Toxicologica
Acta Physiologica Scandinavica
Acta Protozoologica
Acta Virologica
Acta Zoologica (Sweden)
Acta Zoologica Fennica
Advances in Anatomy, Embryology and Cell Biology
Alabama Conservation
Alaska Department of Fish and Game Informational Leaflet
Alaska Department of Fish and Game Technical Data Reports
Alaska Fish Tales & Game Trails
Ambio
American Journal of Anatomy
American Journal of Physiology
American Journal of Science
American Midland Naturalist
American Museum Novitates
American Naturalist
American Scientist
American Zoologist
Animal Behavior
Animal Learning and Behavior
Animal Regulation Studies
Annales de Biologie Animale Biochemie Biophysique
Annales de Genetique et al Selection Animale
Annales d'hydrobiologie
Annales L'Institut Oceanographique
Annales de Limnologie
Annales des Sciences Naturelles Zoologie et Biologie Animale
Annales of the South African Museum
Annales de Zoologie Ecologie Animale
Annales de Zootechnie
Annals of Applied Biology
Annals of the Cape Provincial Museums Natural History
Annals of Tropical Medicine and Parasitology
Annotationes Zoologicae Japonenses
Annual Proceedings of the Texas Chapter of the American Fisheries Society
Applied Animal Ethology
Applied and Environmental Microbiology
Aquaculture
Archiv fur Fischereiwissenschaft
Archiv fur Hydrobiologie
Archiv fur Hydrobiologie Supplementband
Archiv fur Tierernaehrung
Archives de Biologie
Archives of Environmental Contamination and Toxicology
Archives of Toxicology
Archives de Zoologie Experimentale et Generale
Arctic
Arctic and Alpine Research
Arkansas Game and Fish
Astarte

Australian Journal of Biological Science
Australian Journal of Marine and Freshwater Research
Australian Journal of Zoology
Australian Zoologist
Bamidgeh
Bangladesh Journal of Scientific and Industrial Research
Behavioral Biology
Behavioral Ecology and Sociobiology
Behavioral and Neural Biology
Behaviour
Bijdragen tot de Dierkunde
Biochemical Genetics
Biochemical and Systematic Ecology
Biochimica et Biophysica Acta
Biologia
Biological Bulletin
Biological Conservation
Biological Journal of the Linnean Society
Biological Reviews of the Cambridge Philosophical Society
Biologisches Zentralblatt
Biologist
Biology of Reproduction
Biometrics
Bios
Bioscience
Biosystems
Biotechnology and Bioengineering
Biotropica
Brimleyana
Bulletin of the Alabama Museum of Natural History
Bulletin of the American Museum of Natural History
Bulletin of the British Museum (Natural History) Zoology
Bulletin of the Ecological Society of America
Bulletin of Environmental Contamination and Toxicology
Bulletin of Experimental Biology and Medicine
Bulletin of the Faculty of Fisheries Hokkaido University
Bulletin of the Fisheries Research Board of Canada
Bulletin of the Japanese Society of Scientific Fisheries
Bulletin of Marine Science
Bulletin of Mathematical Biology
Bulletin of the Museum of Comparative Zoology
Bulletin of the Shrimp Culture Research Center (Jepara)
Bulletin de lo Societe Zoologique de France
Bulletin of the South Carolina Academy of Science
Bulletin of the Southern California Academy of Science
California Academy of Science Occasional Papers .
California Cooperative Oceanic Fisheries Investigations Reports
California Department of Fish and Game Fish Bulletins
California Fish and Game
Cal-Neva Wildlife Transactions
Canadian Field-Naturalist
Canadian Journal of Behavioral Science
Canadian Journal of Zoology
Cell and Tissue Research
Ciencia e Pratica
Ciencias Marinas
Clinical Toxicology
Coastal Zone Management Journal
Colorado Outdoors
Commercial Fish Farmer
Comparative Biochemistry and Physiology A Comparative Physiology
Comparative Biochemistry and Physiology B Comparative Biochemistry
Comparative Biochemistry and Physiology C Comparative Pharmacology
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences Naturelles
Comptes Rendus des Seances de la Societe de Biologie et de ses Filiales
Conservationist
Contributions in Marine Science
Copeia
Critical Reviews in Environmental Control

Critical Reviews in Toxicology
Cryobiology
Deep-Sea Research
Delaware Conservation
Developmental Biology
Dissertation Abstracts International B Science and Engineering
Doklady Biological Sciences
Dynamics of Atmospheres and Oceans
Ecological Law Quarterly
Ecological Modelling
Ecological Monographs
Ecology
Ekologia Polska
Endocrinology
Environmental Affairs
Environmental Conservation
Environmental Law
Environmental Management
Environmental Planning
Environmental Pollution
Environmental Research
Environmental Science and Technology
Estuaries
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Experimental Parasitology
FAO Fisheries Reports
FAO Fisheries Technical Paper
Fieldiana Zoology
Fish Disease Leaflets
Fish Distribution Report
Fish Farming International
Fisheries
Fisheries and Environment Canada Fisheries and Marine Service Technical Reports
Fishery Bulletin
Fisheries Research Board of Canada Miscellaneous Special Publications
Fisheries Research Technical Report of the Ministry of Agriculture, Fisheries and Food
Fisken og Havet
Fiskeridirektoratets Skrifter Serie Havundersokelser
Florida Scientist
Florida Wildlife
Freshwater Biology
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Georgia Journal of Science
Great Basin Naturalist
Great Lakes Fishery Commission Technical Reports
Heredity
Hydrobiologia
Hydrobiological Bulletin
Illinois Natural History Survey Bulletin
Indian Journal of Animal Science
Indian Journal of Environmental Health
International Journal of Parasitology
International Journal of Radiation Biology
International Pacific Halibut Commission Scientific Report
International Pacific Halibut Commission Technical Report
Investigations in Fish Control
Iowa Conservationist
Iowa State Journal of Research
Israel Journal of Zoology
Japanese Journal of Applied Entomology and Zoology
Japanese Journal of Ecology
Japanese Journal of Genetics
Japanese Journal of Limnology
Journal of the Acoustical Society of America
Journal of the Alabama Academy of Sciences
Journal of Anatomy
Journal of Animal Ecology
Journal of Animal Morphology and Physiology

Journal of Animal Physiology and Animal Nutrition
Journal of Applied Ecology
Journal of the Arizona Academy of Science
Journal of Biogeography
Journal of the Bombay Natural History Society
Journal of the Colorado-Wyoming Academy of Sciences
Journal of Comparative Ethology
Journal of Comparative Physiology A Sensory, Neural, and Behavioral Physiology
Journal of Comparative Physiology B Metabolic Transport Functions
Journal of Ecology
Journal of the Elisha Mitchell Scientific Society
Journal of Embryology and Experimental Morphology
Journal of Endocrinology
Journal of Environmental Economics and Management
Journal of Environmental Management
Journal of Environmental Pathology and Toxicology
Journal of Environmental Quality
Journal of Environmental Science
Journal of Environmental Science and Health A Environmental Science and Engineering
Journal of Environmental Science and Health B Pesticides, Food Contamination and Agricultural Wastes
Journal of Environmental Systems
Journal of Experimental Biology
Journal of Experimental Marine Biology and Ecology
Journal of Experimental Zoology
Journal of the Faculty of Fisheries and Animal Husbandry Hiroshima University
Journal of the Faculty of Marine Science and Technology Tokai University
Journal of Fish Biology
Journal of the Fisheries Research Board of Canada
Journal of General Physiology
Journal of General Virology
Journal of Great Lakes Research
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Journal of the Inland Fisheries Society of India
Journal of the Marine Biological Association of the United Kingdom
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Journal of Wildlife Disease
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Libyan Journal of Science

Life Sciences
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Limnology and Oceanography
Louisiana Conservationist
Louisiana Wildlife and Fisheries Commission Technical Bulletin
Maine Fish and Wildlife
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Marine Pollution Bulletin
Maryland Conservationist
Massachusetts Wildlife
Masters Abstracts
Mauri Ora
Meddelelser fra Danmarles Fiskeri-og Havundirsogelser
Michigan Department of Natural Resources Fishery Research Report
Michigan Natural Resources
Micronesica
Minnesota Volunteer
Minnesota Department of Natural Resources Section of Fisheries Investigational Reports
Mississippi Game and Fish
Missouri Conservationist
Montana Outdoors
Moscow University Biological Science Bulletin
National Parks and Conservation Magazine
Natural History
Naturaliste Canadien
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Nature Canada
Nebraskaland
Nematologica
Netherlands Journal of Zoology
New Hampshire Fish and Game Department Survey Report
New Hampshire Natural Resources
New Jersey Outdoors
New Mexico Academy of Science Bulletin
New Mexico Wildlife
New York Fish and Game Journal
New Zealand Journal of Marine and Freshwater Research
New Zealand Journal of Science
New Zealand Journal of Zoology
New Zealand Ministry of Agriculture and Fisheries Fisheries Research Bulletin
New Zealand Ministry of Agriculture and Fisheries Fisheries Technical Report
NOAA Technical Report NMFS Circular
NOAA Technical Report NMFS SSRF
Norsk Institutt for Vannforskning
North Dakota Outdoors
Northeast Gulf Science
Northwest Science
Occasional Papers of the Museum of Texas Tech University
Occasional Papers of the Museum of Zoology, University of Michigan
Oceanology
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Ohio Fish and Wildlife Report
Ohio Journal of Science
Oikos
Ontario Fish and Wildlife Review
Oregon Wildlife
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Outdoor Oklahoma
Pacific Science
Pacific Search
Parasitology
Pesticide Biochemistry and Physiology

Pesticide Science
Pharmacology, Biochemistry and Behavior
Philippine Journal of Fisheries
Philosophical Transactions of the Royal Society London B Biological Sciences
Physiological Zoology
Physiology and Behavior
Piscator
Prairie Naturalist
Proceedings of the American Society of Civil Engineer, Journal of the Environmental Engineering Division
Proceedings of the Annual Conference of the Southeast Association of Game and Fish Commissioners
Proceedings of the Annual Conference of the Western Association of State Game and Fish Commissioners
Proceedings of the Annual Meeting World Mariculture Society
Proceedings of the Arkansas Academy of Science
Proceedings of the Biological Society of Washington
Proceedings of the California Academy of Science
Proceedings of the Helminthological Society of Washington
Proceedings of the Indian Academy of Science Section A
Proceedings of the Indiana Academy of Science
Proceedings of the International Association of Fish and Wildlife Agencies
Proceedings of the Iowa Academy of Science
Proceedings of the Japan Academy B Physical and Biological Science
Proceedings of the Louisiana Academy of Science
Proceedings of the Montana Academy of Science
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Proceedings of the Nebraska Academy of Sciences and Affiliated Societies
Proceedings of the North Dakota Academy of Science
Proceedings of the Oklahoma Academy of Science
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Proceedings of the Rochester Academy of Science Inc.
Proceedings of the Royal Society of Edenburgh Section B Biological Science
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Proceedings of the South Dakota Academy of Science
Proceedings of the West Virginia Academy of Science
Progressive Fish-Culturist
Quarterly Review of Biology
Report of the Institute of Freshwater Research of Drottingholm
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Royal Ontario Museum Life Sciences Occasional Papers
Sarsia
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Science of the Total Environment
Scientia Sinica
Scientific American
Scientific Reports of the Hokkaido Salmon Hatchery
Scottish Fisheries Bulletin
Scottish Fisheries Information Pamphlet
Scottish Fisheries Research Report
Senckenbergiana Biologica
South African Association for Marine Biological Research Investigational Report
South Carolina Marine Resources Center Technical Report
South Carolina Wildlife
South Dakota Conservation Digest
Southwestern Naturalist
Soviet Journal of Developmental Biology
Soviet Journal of Ecology
Swiss Journal of Hydrology
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Tennessee Wildlife
Texas Journal of Science
Texas Parks and Wildlife

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Toxicology and Applied Pharmacology
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Transactions of the Missouri Academy of Science
Transactions of the Nebraska Academy of Science
Transactions of the North American Wildlife and Natural Resources Conference
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Virginia Wildlife
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Water Resources Bulletin
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Wisconsin Department of Natural Resources Fish Management Report
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